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IN THE LAND OF GINGER—JAMAICA.

By F. B. Kilmer.

The books state that "Zingiber officinale, Roscoe (Amomum zingiber), is a native of Asia, and that it has been introduced into most tropical countries, and is now found in the West Indies, South America, tropical western Africa, and Queensland in Australia." But the vial handed over the drugstore counter, even though it may contain a weak decoction of pepper, will invariably be labeled "Jamaica Ginger." In these notes we shall, therefore, study this plant as seen in its popular habitat, thus keeping in sympathy with the West India planter, to whom the only known spot where ginger grows is in his sunlit garden.

In the track of the ocean steamers sailing from New York or Liverpool toward the southern continent, as they pass from the cold grey waters of the Atlantic into the warm blue waters of the Caribbean Sea, at a point in the windward passage 100 miles west of San Domingo, 90 miles south of Cuba, lies Jamaica. Donnely created his island of "Atlantis" in these waters. Assuming his story to be true, St. Jago, the gem of the Antilles—Ginger Land—is a favorable location for his Eden. By a vivid imagination we might, from the present inhabitants, trace a lineage back through Ham, and arrive at a picture of Adam planting ginger in the first garden. As the traveler approaches Ginger Land he is impressed with the magnificence and beauty he sees outlined against a perfect sky, terrace upon terrace of mountains upon mountains spring into

view, dark purple mountains, rent by fissures, jutting into the blue heavens. The shores are covered with lively green down to the water's edge; here and there a white spot, completely embowered in foliage, marks the plantations and settlements. Columbus formed a relief map of this island for his queen by crumpling a piece of paper in his hand. The landscape of Ginger Land is truly crumpled but picturesque, and the ginger plant grows luxuriantly on the steep sides of its crumpled elevations, from 2000 feet up to the lofty summits of the blue mountain range. In gorges, in romantic glens, sinks, cockpits, valleys, through the ages there has been deposited a rich, humus soil, this is drained by innumerable streams, along the banks of which, among everblooming tropic flowers, ginger finds a congenial habitat.

One of the essential requirements for the growth of this plant is sunshine—Old Sol is here young, bright and active.

Another requisite for growth—moisture—is also here in plenty. In some portions, 281 inches, or 23 feet, is recorded as an annual downpour. In the "ginger district," 88 inches, or over 7 feet, has been the mean annual rainfall for the last twenty years. (In a report made by one of my correspondents in this district, October, 1897, 47 inches, or nearly 4 feet, of rainfall were recorded in sixteen days.) While ginger grows at suitable elevations all over the island, it is mainly produced in the central western portion, along the borders of the parishes of Westmoreland, St. Elizabeth, Manchester, Clarenden, Trelawney and St. James. The underlying soil of this district consists of white and yellow limestone, with trappean formation; this is covered in some of the nooks or valleys with a pulverent mould or loam deposit several feet in depth. The plant grows luxuriantly in such soil, but apparently will not thrive in marshy soil, nor where there is present more than 10 to 20 per cent. of clay or 30 per cent. of sand. The government returns for the whole island give only about 250 acres of land devoted to ginger. This amount of acreage would not yield the crop harvested. But the real cultivation is not in acres, many cultivators having beds varying from 6 feet square up to the size of a building lot. A few cultivate from one to six acres. Large plots are very rare. For the most part, it is put in the ground in any convenient spot, alongside pineapples, yams, cocoa, cassava or other plants, often in the midst of a dense growth of bush or weeds.

In the statistics of this fertile island this article does not figure in pounds, shillings and pence as largely as do some of its other pro-

Sir Henry Arthur Blake, K. C. M. G., Governor of Jamaica.

ducts. Economically speaking, however, ginger is one of its most important articles of commerce. In my judgment, from 25,000 to 50,000 of its people are more or less dependent upon the ginger

crop for such ready money as is essential to maintain their existence. The cultivation and gathering of this drug is largely in the hands of that peculiar class of West Indian peasants known as Quashie. Quashie is the title given the snuff-colored and brown people as distinct from blacks, that make up nine-tenths of the inhabitants of the West Indies.

Though I know him well, it would be impossible to paint Quashie in words. To appreciate him, one must be in his actual presence. From a Northern standpoint he is poorly equipped for the battle of life; he is simple-hearted, unambitious, and intellectually poor. Life to him is not serious, nor very earnest. It is more like a sunny dream. He lives in a hut far back from the road, a home bowered in tangled foliage brilliant with flowers. It is one-storied, one-roomed, unfloored, thatched with palms, opening all around, plenty of ventilation, but it is orderly, clean and tidy. He has a buxom mate, numerous daughters, but few sons. Like him, they are all symmetrically cast, clean, and full of tropical vitality. Food is more than abundant; it drops from the trees and springs up from the ground. Ever so few shillings pay the taxes, and supply clothing and all other wants, whether of necessity or luxury. He owes no man, and no man owns him. Thus, in humble surroundings, the typical ginger planter lives in more independence, ease and contentment than any dispenser of Jamaica ginger may even hope to attain.

The ginger planter is not given to taking in knowledge or giving out information. Long and vigorous cross-questioning will, in the end, only elicit the fact that he "doesn't rightly know" anything about ginger, or how much will be his own or his neighbor's crop. To the price or crop prospects, improvements in cultivation, difference in quality, he gives little thought or care. He divides ginger into "blue" and "yellow" from the color of the rhizome. These are also known as, respectively, "turmeric" and "flint." I was unable to see any botanical difference in the plant producing the two different colored root-stalks, and many intelligent planters were unable to distinguish the kinds without first examining the root. If anything, it seemed to me that the blue was a degenerate species. The root of the blue is hard and fibrous, yields a much

less proportion of powder, is less pungent, and therefore less valuable commercially.[1]

There is also a division into "plant" and "ratoon" ginger. Plant ginger is ginger that is planted each season; ratoon ginger is really a product of laziness. It is a return crop, secured by leaving a part of the "hand" containing a bud in the ground when the crop is harvested. Ratoon ginger is much smaller in size of hands than the planted, and loses each year in flavor, each successive crop being less and less in amount.

GINGER PLANTING.

Ginger is planted in March and April. The planting process consists in burying the divided fingers, each division containing an "eye" or embryo, in trenches or holes a few inches below the surface and about a foot apart, similar to the process of planting potatoes. The small grower simply digs a hole in a convenient spot. The thrifty planter first burns over his plot, to destroy weeds and insects, then ploughs and lays the plot out into beds and trenches.

The growing plant needs plenty of sun, and the weeds and bushes must be kept down. This latter is a perplexing problem, unless the weeds have been destroyed before the ginger has been planted. If the weeds are pulled or the ground disturbed while the plant is growing, water is apt to settle around the roots, and this rots them. The average Jamaica planter is not given to work, and he generally lets the weeds and ginger solve the question by fighting it out for themselves.

The reed-like ginger plant, with its leafy stems, grows sometimes to a height of 5 feet; its cone-topped flowering stems reach from 6 to 12 inches, and, in a well-cleaned field, make a pretty show when in their September bloom.

On wet soil and during very rainy seasons the root is subject to what is termed "black rotten." This is a rotting induced by warm, soggy soil. The root swells in spots, fills with water, turns black, and emits an offensive odor. In this condition it is attacked by insects and worms, which has given rise to the belief among the planters that the rotting is caused by a so-called ginger worm. (It is possibly a fungus disease.)

[1] I found some shippers in Jamaica ports who were exporting the undried "blue" ginger to supply the demand for green ginger as used in pickling and preserving.

HOMES OF THE GINGER GROWERS.

Growing ginger must be well watered. Irrigation is practised to a limited extent, but in most of the parishes this is unnecessary, as the rainfall is abundant. Fertilization, though highly important, is rarely attempted, partly owing to the small profit, but largely owing to the customs of the country. The most that is ever done is to plough in the weeds and cover the ground with banana trash. Rarely will the planter ever gather up the manure from his live stock and throw it on the ginger-bed. There are no stables used in Jamaica, therefore no such thing as a compost heap. Sea weeds and watering the beds with sea water have been tried experimentally with good results; but no matter how large-sized roots or how fine a quality would be yielded, the average planter would not take the trouble to work his ground in a scientific manner.

An all-important feature is the rapid impoverishment of the soil that follows the ginger culture. One planter told me that only ferns would grow on the soil after exhaustion by this crop. There is thus a constant demand for virgin soil to secure the best-paying crops. This is attained by sending valuable timber up in smoke, as one authority tersely expressed it. "Dried-up streams, general barrenness, in fact a wilderness marks the progress of ginger culture."

The situation is clearly summed up by Mr. Wm. Fawcett, Director of Public Gardens for Jamaica, from whose report to the Honorable Colonial Secretary I quote:

"The soil which produces the very highest quality ginger, realizing, perhaps, £10 per cwt. in the London markets, is the very deep black soil of virgin forest. To grow ginger under this condition involves the destruction of large areas of forest. Magnificent trees, 6 feet in diameter, may be seen in some districts lying rotting on the ground, while the ginger cultivators have gone further to the centre of the island, abandoning the woodlands already cut down. The plan adopted in clearing a forest is for a cultivator to invite ten or twelve of his friends to a 'cutting match.' He provides food and drink, and the laborious work of felling trees is carried on merrily and without much expense. Afterwards, fire is put and the place is burnt over. This burning is considered very important, as much so as the virgin soil.

"Probably its importance is due principally to the deposit of potash and other mineral matters contained in the ashes, but the fire

will also sweeten the ground, correcting sourness; and, moreover, it destroys insect pests. Some cultivators will only grow ginger in freshly-cleared woodland, and next year they move on to a new clearing; but although in this way they get very fine ginger, it is at the expense of forest land which would require a heavy outlay and perhaps a term of 100 years to restore. Albert Town was not long ago a great centre for the cultivation, but I was told there that growers had already got as far as 14 miles further inland.

"Ginger can be, and is, grown in many places year after year on the same ground. An intelligent cultivator at Borbridge stated that he knew of ginger growing for forty years in the same patch. Sanford Town is a German colony, and one of the original colonists, Somers, an active old man of eighty years of age, has been cultivating ginger and arrowroot there since his youth. He and the other colonists have been in the habit of planting a small patch one year, leaving it to ratoon as long as it was profitable, then throwing it up or growing other plants until, after a term of years, they again plant the same patch with ginger. This is an irregular rotation of crops; 'plant ginger,' the product of planting, is of better quality than the ratoons, and the ratoons in each succeeding year are inferior. When the ground is too poor to grow 'white ginger,' the 'blue ginger,' the inferior variety, can be grown.

"More depends upon the curing of ginger, considering the crop as a livelihood, than soil. I believe that the badly-cured ginger brought sometimes to the market is due to wet weather, rather than to want of care.

"The export of ginger is, on the whole, on the increase, but if this is accompanied by the gradual destruction of woods and forests, it is not a subject of congratulation."

An examination of the exhausted soil revealed the fact that it was deficient in organic matter, lime, phosphoric acid and soda. Attempts made, at my suggestion, to supply these deficiencies by the use of market fertilizers of various kinds were not productive of any favorable results. Stable manure alone resulted in a failure, as likewise did the use of a bat guano found on the island. The use of a marl, especially when mixed with stable manure, was a partial success.

The Jamaica Agricultural Society, in 1895, began a series of practical experiments which are still in progress. Their first results,

gathered in February, 1897, were somewhat affected by a drought in the previous November. Upon a limited area of worn-out land, which in a check experiment gave no return, they secured a crop which would be equivalent to over 2,500 pounds of cured per acre, and the product was of extraordinary size and quality. The fertilizer aiding in bringing this result was a mixture of marl with a compound fertilizer made up of about 10 per cent. each of soluble phosphates, ammonia and potash salts. These results were very encouraging and the society have extended them by securing larger plots, giving aid to planters in the way of furnishing fertilizer, etc., returns from which will be gathered in the spring of 1898.

The solution of the problem of reclaiming land exhausted by the ginger and other crops, and the prevention of the further wasteful destruction of valuable soil, is in Ginger Land one of great moment. There is in this fair Island thousands upon thousands of acres of abandoned land, lying within easy reach of roads and ports; much of it has been abandoned because the soil has been exhausted by ginger or coffee. If by suitable tillage and manures it can be reclaimed, great benefits to the inhabitants will follow.

Ginger, as we know it, is the root-stalk of the plant. The root proper or root fibres are about ½ inch long, not very numerous, dying off as the rhizome advances and leaving a slight scar. As regularly-shaped hands, with more or less straight fingers, command the higher price in markets, experiments were made to secure a regular-shaped growth. Owing to the peculiarities of the native planter, instructions were not closely followed and the results were unsuccessful. The fact was developed that a sprout starts from the parent eye, and from this stem, in turn, lateral shoots or branches develop in pairs. These side branches again develop in pairs, these pairs generally alternating to opposite sides. It was found that if the soil was well worked and pulverized before planting, the growth was straighter than when planted in hard soil. Some difference was noted also in the condition of the parent plant; if this was well developed and vigorous, the resultant root-stalk was of a better type than where the parent was small, knarly and crooked. The Botanical Department is now experimenting with selected plants.

GATHERING THE GINGER CROP.

Ratoon ginger is gathered from March to December, but planted ginger is not ready for digging until December or January, and from then until March is the "ginger season."

Ginger is known to be ready for harvest when the stalk withers. This begins shortly after the bloom departs. The rhizomes are twisted out of the ground with a fork. In this operation, every bruise or injury to the hands is detrimental to the market value. There is quite a knack in doing this, and it takes long practice to become expert.

The hands are thrown in heaps, the fibrous roots are broken off, and the soil and adherent matter removed. This must be done quickly after removal from the earth, for, should the ginger be dried with the soil and roots still adhering, the product would not be white, and, if it lies in heaps before drying, it will mould. The custom is to throw it immediately into a dish of water; it is then ready for the uncoating or peeling operation; this is done by hand. A planter who has any quantity of it on hand, will make a "peeling match" by gathering his own numerous family, and whatever help his neighbors can afford. The ginger season thus becomes a time of merry-making.

It was my privilege and a part of my studies to be present at one of these peculiar harvest-home gatherings in Ginger Land. I was given a point of vantage overlooking the dancing hall, which on this occasion was the cement floor of the barebcue. The light of a few sickly lanterns, a smoky torch and the hot glare of the tropical moon gleamed on the dusky men and maiden ginger-peelers. Their dresses were marvels in color, the men in somber black, except for white vests and rainbow sashes. Against the dark-skinned forms of the gentler sex were brilliant reds, yellows, green and blues. Their skirts stood out balloon-like, stiff with cassava starch. Trinkets of silver and gold were heavy and plentiful. They danced to the music of squeaky accordions, clapping of hands, and the plaintive, wailing, but musical voices of the on-lookers. There was plenty of noise—plenty of ginger in that dance. The native "Spiritus saccharum jamaicaiensis" was dispensed freely, but I have seen much less orderly merry-makings in our own land of culture, and in all that excited, hot-blooded crowd not one was drunk or committed any flagrant breach of propriety. Past midnight I lay

down on the only bed that the hut of my host Quashie afforded; at intervals I awoke, to find that the ginger dance was still on. When the first rays of light came over blue mountain peak, there, on the bed, under the bed, sprawled in heaps, over the floor, were the exhausted dancers, fast asleep. But for all they had made such a night of it, before the sun's rays had entered the cabin they had bathed their bodies in the cool spring, taken a cup of coffee, and were fresh for the day's work.

PEELING GINGER.

Ginger-peeling is an art, and there are many expert peelers in Jamaica. The ginger knife is simply a narrow-edged blade riveted to a handle. In large operations an expert peels between the fingers of the hands, less experienced hands peeling the other portions. Examination of a transverse section of ginger will show the import ance of the operation. There is an outer striated skin under which there are numerous layers of very thin-walled cork cells. This layer contains numerous oil cells, the oil cells being most numerous at the bud points. The oil contained in these cells, in specimens fresh from the ground, is almost colorless, very pungent, and exceedingly aromatic. It becomes yellow very quickly on exposure to the air, and, even upon drying without removing the epidermis, its delicate aroma is found to be fleeting. On drying the ginger the contents of these cells appear as a yellow, pitchy mass. (It has been stated that this coloring matter is identical with that of Curcuma.) As this cork layer is the seat of the greatest amount of oil and resin cells, it will readily be seen that the deeper the peeling so much the more of these substances will be carried away with the epidermis, and more cells opened from which these principles may exude.[1]

As fast as peeled, the roots are thrown into water and washed. The purer the water and the more freely it is used, the whiter will be the product. Generally a very little water washes a great deal of ginger. The hands are peeled during the day, and allowed to remain in the water over night. This water acquires a slimy feeling and, if concentrated, becomes mucilaginous and acquires a warm and aromatic taste. The natives claim that this process soaks out the

[1] The Jamaica agricultural society has advertised in the United States and England the desirability of a machine or apparatus to be used in removing the coating from ginger; experiments along the line are now being made.

"fire and poison" from very hot ginger. I placed some pieces in a stream of running water for twelve hours, and succeeded in making them several shades lighter in color. This sample proved to be less pungent to the taste, and it is quite possible the force of the water carried away some portion of the aromatic principles.

A few planters use lime juice in the wash water. This gives a whiter root, having some solvent action on the coloring matter, but, as the lime juice contains saccharine and pectose matter, it prevents drying, and mildew follows. In another experiment I supplied the natives with citric acid, vinegar and acetic acid. They all worked fairly well, citric acid being the best whitening agent, but it was reported that the process was expensive and troublesome.

It is generally stated that ginger is deprived of its coat by being

Barbecue used in Drying Ginger.

plunged into boiling water before being scraped. This practice is not used to any extent in Jamaica. Its effect is to swell the starch and bassorin-like gums. I found that after keeping the freshly-peeled root-stalks in boiling water for an hour they were considerably swollen and the steam was filled with the aroma of the ginger. Under this treatment the coating comes off easily; but, if the action of the boiling water is prolonged, the starch and fibre are acted upon, the product dries hard and the color is darkened. In fact, what is known as "black ginger" of the market is the result of this process. Ginger is found in the market coated with calcerous matter, such as carbonate of lime, etc., this is said to be to fill a demand for "white ginger." Such a proceeding is apparently unknown among the planters. Well-cured ginger has a decided white coating and that is all they know about it.

It has been stated that it is a common practice to bleach ginger with the fumes of chlorine or sulphurous acid. It may be done in the other parts of the world, but no instance of it is known in Jamaica.[1] There is scarcely a planter with intelligence enough to use, or who would take the pains to employ, such a process. I tried chlorine gas as a bleaching agent, but at best the product was of a dirty yellow color. By using the fumes of burning sulphur, the whole being partially enclosed in glass, the heat of the sun aiding in the experiment, the ginger was whitened and mildew prevented. I found on trial that it might be of service to place the ginger in a weak solution of chloride of lime before drying; this would aid in bleaching and prevent mould.

CURING GINGER.

After washing, the process of drying follows: The tropical sun is the drying agent in all cases. Large operators have what is called a "Barbecue." This is a piece of ground several feet square, leveled off and laid with stone and the whole coated with cement. It is placed so as to receive the greatest amount of sunshine. The small planter uses what is called a "Mat," consisting of sticks driven into the ground, sawbuck fashion, and across these sticks are laid boards, palm, banana or other large leaves; oftener than otherwise, the place for drying is a few palm leaves spread upon the ground.

Careful handlers put their ginger out as the sun rises, and turn it over at mid-day, taking it in at sundown. Rainy or cloudy weather invites mildew. It requires 6 to 8 days for the root to become thoroughly dry. I made several tests to ascertain the loss in weight by drying in the sun, and found the average to be nearly 70 per cent.

Ginger dried in the sun for the market examined for moisture gave the following results:

Six samples, well-dried specimens, showed a further loss when dried at 100° C. as follows: 7·2, 8·5, 8·9, 9·5, 10, 11, 12 per cent.

Several poorly-dried specimens, some of which were damp and mouldy, gave from 15 to 26 per cent. moisture when dried at 100° C. During the progress of my attention to this subject, several attempts were made to utilize artificial heat in drying ginger. Such a course would, in some respects, be a very desirable one.

[1] Bleaching by chemicals and coating with powders are market processes unknown to the planters.

In a portion of the island given almost entirely to the cultivation of this product, a few years ago a wet season prevailed. It was impossible to dry the crop in the sun; as a consequence there was a loss of the crop, followed by considerable distress among the planters.

During my observations an attempt was first made to dry without removal of the skin coat. This, if successful, would have meant the saving of considerable labor. The product was quite dark, the flavor not as good as that of the sun-dried. By removing a part of the coat the drying was hastened. Dr. A. G. McCatty, a practicing physician and owner of a plantation, at my suggestion, placed in operation an American fruit evaporator. It was necessary to use wood as a source of heat, and, partly owing to the high temperature and partly from the ignorance of the operator, the product so

"Mat" for Drying Ginger.

far has been rather poor in quality, the color many shades darker, much of the aroma was lost, and a smoky, burned flavor acquired. Other planters are trying the process on this year's crop.

A curious incident resulted during these experiments. The natives, through prejudice against innovations, boycotted the drying apparatus, and refused to furnish supplies at any price. Experiments were made with calcium chloride as a drying agent. The result did not equal samples produced by the native method of drying in the sun. Attempts made to dry the ginger after first slicing, as might be expected, resulted in great loss of flavor and pungency. My conclusions were that, when well conducted, the native method of careful peeling and curing in the sun would produce a handsomer and a better product than any process yet suggested.

These observations were not undertaken with a view of making

any complete analysis, and it was found that a macroscopic examination by expert judges was far more reliable than any assay that could be made with limited facilities present in the ginger fields. A few such examinations were made as follows:

Ethereal Extract.—Exhaustion of the ginger with ether in a Soxhlet extraction apparatus. The resultant extract, after evaporation of the ether, was dried over sulphuric acid to remove moisture. From this extract the volatile oil was calculated by the loss on drying the ethereal extract at 110° C. for three hours. The only results from this process that seemed to be of value were that the finer grades, when carefully dried, contained a higher percentage of volatile oil.

Ginger dried without removing the peel gave somewhat higher results as to volatile oils than the peeled. The loss of this constituent was greater in a product dried by artificial heat than when dried by sun. The amount of volatile oil found by aforesaid process was, lowest, 1 per cent.; highest, 3·20 per cent. The results as to ethereal extract, exclusive of volatile oil or from alcoholic extract from the ether-exhausted residue, seemed to be of little value, the different specimens giving such greatly changing amounts as to afford no guide.

In these experiments some observations were made that were interesting, though of no particular value. In the extracts from ratoon ginger there was evidently a more fiery taste and less flavor than in the planted ginger. This was also true in regard to the extracts from the blue and yellow varieties, the yellow having a much finer odor and taste. Upon the addition of water to these extracts in sufficient amounts to precipitate the dissolved resins, it was observed that in the case of the well-cured specimens of plant ginger a delightful aroma was imparted to the water, a true ginger flavor, without fire or pungency. But in extracts from old ratoon ginger, from mildewed specimens spoiled in drying, this aroma was greatly changed, becoming musty and weak, the taste in some instances being decidedly bitter. Ninety-five per cent. alcohol was found to give better results as to flavor of extract than that of lower strength.

MOVING TO GINGER MARKET.

When the native tropical sun has fully dried the ginger crop, it is stored in heaps for market day. By unchangeable Ginger Land

customs, there are certain days and times to carry products to market. There are banana days, pineapple days, pimento days and ginger days. The buyer must take in his supplies on these days or go without them.

The ginger crop is carried from five to forty miles to a place of sale. In the proper season, along the white-paved roads, from the cool, refreshing hours of the morning far into the night, ginger may be seen moving to market. The richer planter, with a lace bark rope, leads a heavily-laden donkey with panniers heaped. Sometimes piled high on either side, above the ginger are pineapples, plantains, yams, and strange-looking fruits; over all are bunches of knotted sugar cane and nets filled with green cocoanuts. But by far the greater portion of the ginger, and every other crop, is moved by head-loads.

Troops of Jamaica's brown and yellow daughters are seen trudging up and down hills under the terrible sun, with a load of a hundred pounds or more at graceful equipoise on their gaily-turbaned heads. All have their garments kilted up to their bare dark knees. These women have taken their colors from the fruits: their complexions are orange, olive, sapota, mango, deepening into a bronze-black. They are upright as darts, walk with a free, unhindered stride, without any swinging of the shoulders, impressing one greatly with their grace and elegance of motion. Carrying their heads like queens, without nod or turning, they cry out in a high-pitched musical key, to the bystanders, "Marningbuckra," and pass on, their naked feet making a great whispering sound over the smooth roadway. In a picturesque way ginger passes to the market town.

The market may be in the port town or at the crossroads store. The sign at this latter place reads, in rather shaky characters, "Lisened to dele in Agricultural Produse," which is made to include rum, gin, and a general conglomeration of merchandise, not counting drugs and medicines. In this sort of a place anything in the shape of hands and fingers is ginger, and is dumped into a barrel without any sorting, to be shipped to the port. Often the small shopkeeper is heavily in debt to the large trader in the port, and, when ginger is wanted, makes haste to get in as much as possible, regardless of quality.

IN THE GINGER MARKET.

The markets of these West India towns are the important centres of commerce. Here, in a large open space near the quay, a great hurry and clatter of brisk business proceeds under the beautiful blue sky and blazing sunshine.

Quashie requires much conversation to complete a bargain. One would suspect by the bustle and noise that the entire wealth of the Island was changing hands every few minutes, but the truth is, the most prolonged and loud wrangle closes a transaction involving a minute fraction of a penny. There are a few benches or stalls under the market arcade, but they require a rental fee; so, for many, an upturned barrel outside constitutes a stall. Those who have no barrel pile their wares on the ground between their sprawling black limbs. It is a good place to study fruits and vegetables monstrous in size, with outlandish names, but luscious in looks. Many kinds of drugs are here in their primitive state, ginger in abundance. Nearly every other seller cries out: "Buckrayouwangingafoobuy" (white master, do you want to buy ginger?)

These black people speak with a rolling current of vowels and consonants, pouring them out so rapidly that none but an acclimated ear can detach an intelligible word. The ginger is not weighed, measured or counted, the standard is a "heap." A heap of ginger is a pile that enlarges or diminishes according to the law of supply and demand. If the hands are finely shaped and large, there are fewer in the heap; if they are small, dark and snarly, the heap is made larger. If the price of ginger goes up in London or New York, it is because the heaps in this market have been made smaller. If the price goes down, these heaps have become larger and finer. The price of ginger in the drug exchanges of the world is the reflection of the changing size of these petty heaps in Ginger Land.

The ruling price in Kingston and Montego Bay for the heap is a penny-ha'penny (about three cents). Heaps purchased by me varied according to quality, but the average weight was from one-fourth to one-half pound.

The buyers of ginger for shipping are expert and accurate. They grade, sort and price with a quick eye and ready touch gained by years of practice. The highest grades are large-sized hands of light and uniform color, free from evidence of mildew. This grade is brittle and cracks easily, but broken pieces depreciate the value.

Buyers also require the hands and fingers to be firm and full, without wrinkles or spots. They generally assort into four or five grades, that which is shriveled and small being the lowest. The dark varieties form another, the heavy, tough and flinty a third. These four are finally assorted by placing hands which are small but of good texture and color as one grade. The larger-sized, well-bleached hands into the highest grade.

The ratoon finger sorts generally bring the lowest price, as they are small, soft and soggy, and lack flavor. Ginger gathered green shrivels much in drying, and is less aromatic and pungent than when fully matured. Ginger that has mildewed is spotted, and the mildew starts a decomposition that affects the flavor. Ginger put in bags or laid away before being thoroughly dried will mould and acquire a musty odor and flavor, which it is impossible to remove.

The largest-sized hands are carefully selected by buyers and shipped to special markets, usually to England. I noticed hands weighing as much as eight ounces; many of them weighing from four ounces upward.

Ginger is packed in barrels for shipment.

ECONOMICS.

The amount of ginger exported from this Island during the last ten years is shown in the following table[1]:

	Pounds.
1887	1,121,827
1888	1,141,877
1889	1,002,653
1890 (½ year)	554,193
1891	1,219,197
1892	1,822,531
1893	1,526,884
1894	1,672,384
1895	1,736,460
1896	1,960,609

[1] Figures obtained from the office of the collectors-general of Jamaica show that more than one-half of the crop is shipped direct to the United States ports.

The amount of ginger imported into the United States from all parts of the world, from the years 1890 to 1894, was as follows:

	Pounds.
1890	2,328,825
1891	2,697,989
1892	1,431,295
1893	2,927,942

The yield and profit of the ginger crop depend somewhat upon the nature of the soil. In favorable seasons rainfall, sunshine, planting, care and curing, are also factors. An average yield can be estimated at from 1,000 to 1,500 pounds dried ginger per acre. In exceptional cases, 2,000 pounds have been gathered. There are planters in Jamaica who plant ginger here and there in patches, and gathering as little as a hundred pounds in a year. Ginger is well adapted to the small planter, and admirably suited to the peasantry of Jamaica, who, by slow evolution, are passing from serfdom to manhood and independence.

The exact cost of producing this crop is difficult to calculate. The present output is largely the product of domestic labor, whose value is hard to compute; when this class of labor is hired, it becomes very costly. The figures in the following table are approxmate only; as now conducted there is chargeable against the crop the item of rent, or tax, (if the cultivator is an owner) the labor is mainly that of the family.

An approximate estimate of the expenditures and receipts on an acre of land planted in ginger are as follows:

Ground-rent or tax	$5.00
Clearing land, ploughing and planting	40.00
Cost of plants	50.00
Digging and preparing	15.00
Peeling	45.00
Drying	25.00
Delivery at market	10.00
	$190.00
Fertilizer (if used)	50.00
Superintendence	20.00
	$260.00

Yield: 1,500 to 2,500 pounds (cured ginger), at 12 cents per pound, $180 to $300.

Viewed from this standpoint, the cultivation of ginger on a large scale would be far from remunerative. In this connection we may note that a Royal commission, appointed to investigate the depressed condition of the industries in the West India Islands, have recently submitted a report to Her Majesty's Government. Among the recommendations made was "The settlement of the laboring population on small plots of land as peasant proprietors." This corroborates our view that, from the Jamaica standpoint, it is better economy to leave the cultivation of ginger remain where it is. The introduction

of artificial heat for drying, machinery for peeling, will have a tendency to deprive the peasantry of a source of income, and this, so far as these investigations show, will not improve the quality of the product.

The Botanical Department, through its corps of agricultural instructors, is now going among the people and showing them exactly what may be done in the way of improving their methods of cultivation. The Jamaica Agricultural Society is conducting practical and extensive demonstrations to show the use and value of fertilizers. These have already an important bearing upon this crop. Information recently to hand states that the crop which will be gathered in the coming season (Spring, 1898) will probably be the largest ever grown upon the Island. This is due to the improvements in cultivation, together with an abundant rainfall. Unfortunately for the ginger planter, a largely-increased production will tend to lower prices.

I am aware of the fact that these notes will add but little to the already recorded observations upon ginger. It may be questioned whether such a common article of materia medica merits any extended research. We should, however, realize that any drug that holds a name and place in medicine is of sufficient importance to merit our best efforts.

Our knowledge of the changes which take place in crude drugs, due to the methods of preparation, is very meagre. Karl Dieterich (*Berichte der Deutschen Pharm. Gesellschaft, 1896, p. 335*) says:

"Thus it is that I am convinced that the study and development of this branch of pharmacy will yield far more than theoretical results and that the analysis of fresh and dried drugs at different stages will be of great practical advantage in directing the proper manipulations to be employed in producing uniform and superior products." My convictions are strong that the study of drugs should begin in their habitat and extend to the bedside of the patient. That it is important to know every change that may take place in their cultivation and collection as well as those incident to their preparation for administration, this seems to be sufficient warrant for these observations taken in the Land of Ginger—Jamaica.[1]

[1]In preparing this paper, valuable assistance has been rendered the writer by those whose names are mentioned therein. In addition, he feels indebted to His Excellency, Henry A. Blake, Governor of Jamaica; to the Hon. Q. O. Eckford, ex-United States Consul; to George A. Douet, Esq., Secretary of the Jamaica Agricultural Society; to L. Frazer, of Montego Bay, and many others.

TESTING OF FORMALDEHYDE.

BY CARL E. SMITH.

Report of Research Committee DII., Committee of Revision of the United States Pharmacopœia.

The rapidly increasing uses of formaldehyde make it desirable that standards be established for the strength and purity of the commercial products. A method of assay, simple and rapid, as well as reasonably accurate, is needed as a guide for manufacturer and pharmacist, as also tests for the various impurities liable to be present, and reactions to establish its identity. As the commercial solutions vary considerably in quality, ready means should be at hand for controlling the quality of the pharmacist's supply.

ASSAY METHODS.

A method of assay, to be generally applicable, must not be affected in accuracy by the presence of ordinary impurities frequently contained in commercial formaldehyde solution, such as methyl alcohol and acetone; neither should it require much time and attention or complicated operations. Of the number of methods which have been published within recent years, the principal ones were examined, in order to ascertain which of them approaches nearest to these requirements, with the results stated below:

Hydroxylamine Method.—Proposed by Brochet and Cambier (*Compt. Rend.*, vol. 120, p. 449, and *Ztsch. f. Anal. Chem.*, vol. 34, p. 623). Based on the reaction of hydroxylamine hydrochloride and formaldehyde, with the liberation of hydrochloric acid, according to the following equation:

$$NH_2OH.HCl + H.COH = CH_2N(OH) + HCl + H_2O.$$

The formaldehyde entered into combination is determined by the amount of acid set free.

In the experiments made the details prescribed by the authors were followed, except that $\frac{n}{10}$ soda solution was used for titrating the hydrochloric acid instead of $\frac{n}{10}$ borax solution.

10 c.c. of a solution containing 0·0864 gramme of a concentrated formaldehyde solution were mixed in a small flask with 10 c.c. of a 2·5 per cent. solution of hydroxylamine hydrochloride. (The hydroxylamine salt is about 5 times the amount involved in the

reaction. This large excess was afterward found unnecessary, 50 per cent. excess being quite sufficient.) After standing 10 minutes the liberated acid was titrated, requiring, after deducting 0·1 c.c. for free acid in the hydroxylamine solution, 10·7 c.c. of $\frac{n}{10}$ soda; 1 c.c. = 0·003 gramme formaldehyde.

$$\frac{10{\cdot}7 \times 0{\cdot}003 \times 100}{0{\cdot}0864} = 37{\cdot}2 \text{ per cent.}$$

Several trials were made to determine the time limit of the reaction.

Allowing 20 minutes to complete the reaction, the result was 37·2 per cent.

Allowing 45 minutes to complete the reaction, the result was 37·3 per cent.

Other trials showed that shaking the mixture does not materially hasten the reaction, and that it is practically complete in 7 to 8 minutes after admixture.

The above figures agree closely with those obtained on the same solution by other methods.

The method is quick and accurate, when applied to pure solutions, but the accuracy is interfered with by the presence of other aldehydes and acetone, as stated by G. Romijn (*Ztsch. f. Anal. Chem.*, vol. 36, p. 18). For acetone the statement was verified by a simple test-tube experiment; aldehydes were not tried.

Iodine Method.—Proposed by Romijn (*ibid.*). Nearly identical with Messenger's process for estimating acetone, and therefore unsuitable for the assay of solutions liable to contain *acetone*. It was used only to determine the strength of pure solutions, made from para-formaldehyde, and for this purpose was found accurate and convenient. A very dilute solution of the formaldehyde is mixed with an excess of $\frac{n}{10}$ iodine solution, and caustic alkali solution added until the iodine is decolorized. After standing 10 minutes, dilute acid is added to liberate the excess of iodine, and this estimated with sodium hyposulphite.

Cyanide Method.—Also devised by Romijn (*ibid.*). It is based upon the formation of an addition product of formaldehyde and potassium cyanide, from which the cyanide cannot be precipitated

with silver nitrate. It involves the use of standard solutions of silver nitrate, potassium cyanide, and potassium sulphocyanate. This method requires much more care and attention than any of the others tried, and a few trials showed conclusively that it is not likely to give satisfactory results except in practiced hands. It was, therefore, considered useless to proceed further with it.

Fixed-Alkali Method.—This consists in heating the formaldehyde with sodium or potassium hydrate solution under pressure, in a manner similar to that in the saponification of esters. The formaldehyde is converted into methyl alcohol and formic acid as follows:

$$2\,CH_2O + KOH = CH_3OH + KCHO_2.$$

The method was most satisfactory when conducted as follows: 3 grammes of the sample are placed into a strong bottle of 50 c.c. capacity, with 25 c.c. of $\frac{n}{1}$ soda solution, the bottle closed with a tight-fitting rubber stopper, this tied down with a cord, and the bottle, after wrapping with a cloth, immersed in boiling water for one-half hour. After cooling, the excess of soda is titrated with $\frac{n}{1}$ sulphuric acid and phenolphthalein, each c.c. of soda solution consumed indicating 0·06 grammes, or, if 3 grammes be taken, 0·5 per cent. of formaldehyde.

The time required to complete the reaction is very much less than is stated by others who have tried the method, nor were some other stated disadvantages noticed, such as thickening or resinifying of the solutions. The results were reasonably accurate, except in the case of one commercial sample.. The following figures illustrate the duration and degree of heat necessary. They were all obtained with the same formaldehyde solution:

Heated *in* boiling water.	Per cent.	Heated *over* boiling water.	Per cent.
15 minutes	37·1	15 minutes	32·5
30 "	37·3	30 "	34·5
1 hour	37·6	1 hour	37·1
2 hours	37·2	2 hours	37·7
		3 "	37·3

On *prolonged* heating the solution frequently darkens, so as to make dilution necessary before titrating.

The influence of the presence of acetone and methyl alcohol on the accuracy of the methods was determined.

Acetone.—3 grammes of formaldehyde solution, 25 c.c. of $\frac{n}{1}$ soda solution, and 0·5 c.c. of pure acetone were heated under pressure in boiling water for 45 minutes. A duplicate assay, omitting the acetone, was made under the same conditions. In the mixture containing the acetone a white, flocculent precipitate formed on heating, and titration with sulphuric acid indicated that not more than one-third of the theoretical amount of soda had been used up. The duplicate containing no acetone gave normal figures. No attempt has yet been made to ascertain the composition of the precipitate and the cause of its formation.

Methyl Alcohol—To 20 c.c. of a dilute aqueous solution of pure formaldehyde, 1 c.c. of commercial methyl alcohol was added and the mixture heated with soda solution, as described in the acetone experiment. The solution was assayed under the same conditions without addition of methyl alcohol:

	Per cent.
Without methyl alcohol	4·65, 4·65, 4·71
With " "	4·38, 4·35

Repeated with pure methyl alcohol, 0·5 c.c. of this was added to 2·25 grammes of a concentrated solution of pure formaldehyde:

	Per cent.
Without methyl alcohol	37·3, 37·3
With " "	35·5, 35·7

No explanation can be made at present for the lowering of the result by the presence of methyl alcohol.

The chief disadvantages of the fixed-alkali method are interference by acetone and methyl alcohol and risk of explosion when heating under pressure. It is also subject to some variation in the results—noticed with one sample only—the causes of which cannot be satisfactorily explained at present.

Ammonia Method.—First proposed by Legler (*Berichte*, vol. XVI., p. 1333) and based on the reaction of free ammonia and formaldehyde to form hexamethylene-tetramine:

$$6\,CH_2O + 4\,NH_3 = N_4\,(CH_2)_6 + 6\,H_2O.$$

A normal ammonia solution is usually recommended, while the decinormal is preferred by others. As the use of the latter necessitates weighing or measuring very minute quantities of formaldehyde, or else diluting a larger quantity and taking an aliquot part

for assay, the work was restricted to the use of the stronger solution. Only one trial with a decinormal solution was made, which indicated that the assay would require about one hour, and that rosolic acid is not sufficiently sensitive in presence of hexamethylene-tetramine to give serviceable results until after some practice.

Experiments with $\frac{n}{1}$ ammonia solution: 25 c.c. of the ammonia solution were run from a burette into a flask and 2·25 grammes of sample added. The flask was then closed with a glass stopper thickly coated with vaseline. The mixtures were allowed to stand a definite time, and then the excess of ammonia titrated with $\frac{n}{1}$ sulphuric acid, using rosolic acid as indicator. Each c.c. of $\frac{n}{1}$ ammonia corresponds to 0·045 gramme, or 0·5 per cent., when 2·25 grammes are taken.

	Per cent.
Titrated at once after admixture	36·0
" after 15 minutes	37·4
" " 1 hour	37·5
" " 2 hours	37·5
" " standing over night	37·4

Other trials, previously made in flasks closed with rather loosely-fitting rubber stoppers, gave somewhat variable figures, the tendency being too high results through loss of ammonia, particularly when considerable time elapsed before titrating.

Assay in Presence of Acetone.—A mixture of 2·25 grammes of formaldehyde solution, 25 c.c. of $\frac{n}{1}$ ammonia, and 0·5 c.c. of pure acetone was allowed to stand 20 minutes and then titrated. The solution was assayed in a similar manner without addition of acetone.

	Per Cent.
Without acetone	34·9, 34·7
With "	34·8, 35·0

Assay in Presence of Methyl Alcohol.—A mixture of 2·25 grammes of formaldehyde solution (not the solution used in the preceding experiments), 0·5 c.c of methyl alcohol, pure or commercial, and 25 c.c. of $\frac{n}{1}$ ammonia, was treated in the same manner as above, and the formaldehyde solution also assayed without addition.

	Per Cent.
Without methyl alcohol	37·4, 37·4
With pure " "	37·5, 37·6
" commercial methyl alcohol	36·8, 36·9

According to these figures, commercial methyl alcohol may lower the result slightly, while pure methyl alcohol and acetone exert, practically, no influence. This method, then, is the only thoroughly reliable one of all those tried, the only drawbacks being a slight inaccuracy introduced through loss of ammonia by volatilization, and the necessity of frequently restandardizing the ammonia solution, which loses strength rapidly. These considerations suggested to the writer a modification of this method, which obviates the need of keeping on hand a standard solution of ammonia, and reduces the volatilization of ammonia, during the manipulation, to a minimum.

Ammonia Method Modified.—Dissolve 2 grammes of pure, neutral ammonium chloride in 25 c.c. of water and introduce it into a flask provided with a well-fitting stopper. Add 2·25 grammes of the sample, and then run in from a burette 25 c.c. of $\frac{n}{1}$ potassium (or sodium) hydrate. Stopper the flask at once and put it aside for one-half hour. Then add a few drops of rosolic acid solution and determine the excess of ammonia with $\frac{n}{1}$ sulphuric acid, each c.c. of $\frac{n}{1}$ potassium hydrate consumed indicating 0·5 per cent of formaldehyde.

The results obtained by this modification agree closely with those obtained by the hydroxylamine, fixed-alkali, and ammonia methods. The reactions involved are as follows:

$$NH_4Cl + KOH = NH_4OH + KCl;\ 4NH_4OH + 6CH_2O = N_4(CH_2)_6 + 10H_2O,$$

or,

$$4NH_4Cl + 4KOH + 6CH_2O = N_4(CH_2)_6 + 4KCl + 10H_2O.$$

The ammonia combines with the formaldehyde nearly as fast as it is liberated, and, consequently, has no chance to volatilize, and the final excess is so small that the odor is barely perceptible.

EXAMINATION OF COMMERCIAL SAMPLES.

Sample I.—Colorless, contains a white, flocculent precipitate probably para-formaldehyde, which increases on keeping, more

rapidly when exposed to diffused sunlight than in the dark. Specific gravity, 1·109 at $\frac{15^\circ}{15^\circ}$; free acid, assumed to be formic acid, 0·17 per cent. Residue on ignition, 0·19 per cent., consisting of sodium chloride and a little sodium carbonate.

	Per Cent.
Strength, by ammonia method	37·4, 37·5
" " fixed-alkali "	37·3, 37·6
" " hydroxylamine method	37·2, 37·3

Sample II.—Color faintly yellowish; contains fine particles of extraneous matter, but is free from a deposit of para-formaldehyde. Specific gravity, 1·052 at $\frac{15^\circ}{15^\circ}$; free acid, 0·065 per cent.; traces of acetone; residue on ignition, 0·015 per cent., consisting of copper oxide.

	Per Cent.
Strength, by ammonia method	34·6, 34·7
" " fixed alkali "	35·3, 34·7, 35·6, 34·0
" " hydroxylamine method	34·4, 34·6

Cause of discrepant results by the fixed-alkali method unknown. This solution is claimed to be 40 per cent. strong on the label.

Sample III.—Clear, faintly yellowish; specific gravity, 1·057 at $\frac{15^\circ}{15^\circ}$; free acid, 0·07 per cent.; traces of acetone; residue on ignition, 0·032 per cent., consisting of copper oxide.

	Per Cent.
Strength, by ammonia method (modified)	35·3, 35·2
" " fixed alkali "	35·3, 35·2
" " hydroxylamine method	35·0, 35·1

Samples II and III are apparently made directly from woodspirit, as judged by the presence of acetone, copper, and by the disproportionately lower specific gravity, indicating presence of a lighter liquid, probably methyl alcohol. These samples also have more empyreuma than is the case with Sample I; they leave a smaller residue of para-formaldehyde when evaporated spontaneously and deposit no para-formaldehyde when exposed to daylight for nearly a month.

TESTS OF IDENTITY AND PURITY.

The following list of tests is presented as a convenience to those who may wish to avail themselves of it as a guide in the examination of commercial products. The details of the tests are arranged

in such a manner as experiments seemed to show most practical. No test for methyl alcohol is included, as it was not found practicable to test for it in presence of formaldehyde except by tedious distillation. The pungent odor of formaldehyde completely masks the wintergreen odor obtained by the salicylic acid test, even when a large quantity of methyl alcohol is known to be present.

The solution should contain 35 to 40 per cent. of absolute formaldehyde, as ascertained by the ammonia method or its modification.

It should be transparent and colorless, have a pungent odor and caustic taste, and a neutral or faintly acid reaction. Specific gravity about 1·08 at 15°C. Miscible in all proportions with water and with alcohol. On mixing with an ammoniacal solution of silver nitrate, metallic silver is separated. Heated with alkaline copper tartrate solution, cuprous oxide is separated.

If to 2 c.c. of the solution an equal volume of potassa solution and about 0·5 gramme of resorcinol be added and the mixture heated to boiling, the yellow color which first appears gradually becomes red. (This reaction is said to be given by no other substance.)

If 5 c.c. of sulphuric acid (specific gravity 1·84) be placed in a test-tube with a little salicylic acid and 2 drops of formaldehyde solution added, a permanent deep red color will appear immediately.

If 1 c.c. of the solution be evaporated to dryness on a water-bath after addition of 5 c.c. of ammonia water, a white crystalline residue will remain, which, upon moistening with dilute sulphuric acid and warming, will evolve the pungent odor of the original solution. (Reconversion of hexamethylene-tetramine into formaldehyde and ammonia.)

If 5 c.c. be evaporated to dryness on a water-bath, a white amorphous mass is left, which should leave no residue on ignition (absence of mineral impurities).

Ten c.c. should require not more than 0·25 c.c. of $\frac{n}{1}$ potassium hydrate for neutralization, using phenolphthalein as indicator (absence of more than 0·1 per cent. of formic acid).

A coil of clean platinum wire, dipped into the solution and held into a non-luminous flame, should not color the flame yellow (absence of sodium), nor should it appear violet when viewed through a blue glass (absence of potassium).

Dilute the solution with three times its volume of water for the

succeeding tests. No turbidity or precipitate should be caused by silver nitrate (absence of chloride); nor by barium chloride (sulphate), nor by hydrogen sulphide or potassium ferrocyanide (metals), nor by ammonium oxalate (calcium).

If 1 c.c. of formaldehyde solution be mixed with 10 c.c. of iodine test solution, and potassa solution added until the solution becomes colorless, no precipitate should be formed, nor an odor of iodoform developed (absence of acetone).

The solution should be kept in dark amber-colored bottles, in a cool place, protected from light.

The writer is much indebted to Prof. Virgil Coblentz, in whose laboratory this work was carried on, for his great interest in these investigations, and many valuable suggestions in connection with them.

NEW YORK COLLEGE OF PHARMACY, January, 1898.

THE CHEMICAL ANALYSIS OF THE GASTRIC CONTENTS.[1]

I. Method of Analysis for Use in Clinical Work.

II. Record of the Analyses of the Gastric Contents of Fifty Healthy Individuals.

BY HENRY F. HEWES, M.D.,

Assistant in Chemistry, Harvard Medical School, Boston.

(*Continued from page 44.*)

Lactic acid is not a constituent of gastric juice, and is not produced in the stomach during the course of the normal gastric digestion.[59, 60] Statements contrary to this are found in many of the leading text-books; but the truth of the above statement has been adequately demonstrated by the researches of Bidder and Schmidt, Rothschild, Martius and Luttke, Boas and others.[59]

The presence of this acid, therefore, in the gastric contents, except in the amount ingested in the food as acid or salts, is of pathological significance.[60]

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[1] From *Boston Medical and Surgical Journal*, December 2, 1897.

[59] Martius u. Luttke: Magensaure d. Menschen, have proved this conclusively by establishing a comparison of the total acidity and total hydrochloric acid, and finding that they coincide or run parallel throughout digestion.

[60] Boas: *München med. Woch.*, No. 43, 1893; *Zeit. klin. Med.*, 1894.

The best test for lactic acid for practical work is the ferric-chloride test. A colorless solution of neutral ferric chloride is turned a lemon-yellow (gelbgrun) color by lactic acid. A more striking application of the test is seen in the Uffleman lactic acid test.[62] Uffleman's solution consists of 10 c.c. of 4 per cent. carbolic acid, 20 c.c. of water and one drop of 10 per cent. neutral ferric chloride. The pale amethyst color of this solution is bleached and replaced by a lemon-yellow color by the addition of lactic acid.

This ferric-chloride test responds to the presence of ½ gramme per mille lactic acid. As the amount of lactic acid contained in the Ewald test breakfast is at most $\frac{1}{10}$ gramme per mille, this test can be used as an index of the presence of produced lactic acid after the ingestion of this meal.[61, 63]

In testing for lactic acid in the gastric contents this ferric-chloride test must be used in a modified form, since the straight test or Uffleman modification are interfered with by certain substances which may be present in the normal or pathological contents.[61, 64]

Thus glucose, alcohol, peptones, carbonates, bile, butyric acid, potassic sulpho-cyanide, all substances which may be present in the gastric contents, may, to a greater or less degree, simulate the test.[61] Phosphates, hydrochloric acid and fatty acids, if in sufficient amount,[61] inhibit the test. These substances must, therefore, be excluded before making the test for lactic acid in the contents. A most satisfactory method of excluding these substances and testing for lactic acid in the gastric contents is the De Jong method.[65]

To 5 c.c. of the gastric contents add two drops of strong hydrochloric acid; heat the mixture to a syrupy consistency over a flame or water-bath; shake the residue with 10 c.c. of ether; separate the ether; to this ethereal extract add 5 c.c. of water and one drop of 5 per cent. neutral ferric chloride. If lactic acid be present in amount over ½ gramme per mille, a lemon-yellow color will be obtained.[66]

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[61] De Jong: *Archiv. f. Verdauungskrankheiten*, Bd. II, H. 1; also Langguth, same Archives, Bd. I, s, 365.

[62] Uffleman: *Deutsches Archiv. f. klin. Med.*, Bd. XXVI, s. 431.

[63] Lactic acid may be produced in the normal stomach by the action of free HCl upon the lactates of the food, but it is not built up there.

[64] Boas: *Deutsch. med. Woch.*, No. 39, 1893; *Berl. klin. Woch.*, No. 9, 1895.

[65] De Jong: *Archiv. f. Verdauungskrankheiten*, Bd. II, H. 1, s. 59.

[66] This is the best method for clinical work yet given. The other reliable

In this process butyric acid, potassic sulpho-cyanide, fatty acids and alcohol, if present, are separated by the addition of free hydrochloric acid and subsequent evaporation. These substances would otherwise be taken up by the ether. The lactic acid is taken up by the ether, while the remaining substances, as glucose, peptones, etc., remain in the residual contents.[67] This test includes both free lactic acid and lactates. It will not react to the amount of lactic acid contained in an Ewald test breakfast.[68]

If it is desired to detect the production of very small quantities of lactic acid (2 grammes per mille) the method of Boas must be used. For this test a meal containing no lactic acid is ingested. Boas' meal consists of an oatmeal soup, prepared by boiling 1 drachm of oatmeal in 1 litre of water. One or more hours after ingestion the contents are expressed, and subjected to a very delicate test for lactic acid devised by Boas.[67]

According to our present ideas, the production of lactic acid during gastric digestion occurs as the result of the fermentation of the carbohydrate foods, through the agency of certain bacterial organisms. Whether the fermentation is due to one definite organism or to several different forms of bacteria is not definitely settled. Huffe first demonstrated by scientific methods a specific bacillus as a cause of lactic acid fermentation. This bacillus (acidi lactici) is a short, plump, rod-shaped organism 1 to 1·7 μ in length by 0·3 to 0·40 in thickness.[69]

Miller has found several kinds of lactic-acid-forming bacteria in the mouth in normal conditions—among others, one similar to this bacillus of Huffe in morphological and physiological characteristics.[70] Kauffman and Schlesinger, Rosenheim and others have found that the presence of large numbers of a large bacillus of a type found in the mouth is characteristic of the gastric contents where lactic acid is produced.[71, 72] The action of this bacillus is inhibited by an acidity

methods given are that of Strauss (*Berl. klin. Woch.*, No. 37, 1895), and that of Boas (referred to later). Neither is as simple as the above. The ordinarily used Uffleman-Penzolt test is not free from error.

[67] Boas: *Deutsch. med. Woch.*, No. 39, 1893.

[68] De Jong: *Archiv. f. Verdauungskrankheiten*, Bd. II, H. 1; also Langguth, same Archives, Bd. I, s. 365.

[69] Huffe: Mittheil a. d. Reichsgesundheitsamts, Bd. II, s. 307.

[70] Miller: Die Mikro-organismen der Mundhöhle, Leipzig, 1889.

[71] Kaufman: Bacteriologie der Magengahrungen, *Berl. klin. Woch.*, No. 6, 1895.

[72] Rosenheim: *Loc. cit.*; also *Virchow's Archiv*, Bd. III, s. 414.

of $\frac{7}{10}$ per mille free hydrochloric acid, or 1 to 2 per mille combined hydrochloric acid. In the normal stomach the action of the bacillus is inhibited by the increasing acidity, before any appreciable fermentation can be produced by the few bacilli swallowed with the food.

Where, in pathological conditions, the secretion of hydrochloric acid is absent or slight, and the presence of stenosis or dilatation with resulting stasis of the contents gives a long period for action to the bacillus, great multiplication of the bacilli and fermentation of large amounts of lactic acid occur.[73] This condition is most associated with carcinoma of the stomach, where the combination of the conditions of atrophy of the secreting structures and of stenosis is most common. It may occur in other conditions.[73]

Butyric acid is not a constituent of the gastric juice. It is formed from carbohydrate and milk foods by the action of several bacilli, among them the bacillus butyricus. Physiologically it may occur in the gastric contents after the ingestion of large amounts of carbohydrate foods or milk. After an Ewald meal the amount of butyric acid is never enough in the normal stomach to appear in the tests one hour after ingestion. In pathological conditions, however, lactic and butyric acids may be present in the contents.

The tests of butyric acid are as follows: 10 c.c. of the contents are shaken with 50 c.c. of ether, the ether drawn off and evaporated, and the residue dissolved in water. To this aqueous solution lumps of calcium chloride are added. If butyric acid is present in amount sufficient to be of pathological significance, globules of the acid will separate out in the solution. Butyric acid may be discovered also by adding to the contents alcohol and sulphuric acid, and heating. If butyric acid be present, the pineapple odor of its ethyl ester will be perceived.

Butyric acid, when present in the amount of ½ gramme per mille, gives a tawny-yellow color with ferric chloride. Where the acid is present in considerable amounts, it may be distinguished by the odor of the contents.

Acetic acid may occur in the gastric contents in the presence of abnormal fermentation of carbohydrates. It is never present in the normal contents after an Ewald breakfast. It is produced by the action of a unicellular organism (the Mycoderma aceti) upon the food.

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[73] Hammerschlag: *Archiv. f. Verdauungskrankheiten*, Bd. II, H. 1.

The test for acetic acid is as follows: 10 c.c. of the contents are shaken with 50 c.c. of ether, the ether drawn off and evaporated, and the residue dissolved in water. This aqueous solution of the ethereal extract is neutralized with sodic-hydrate, and a few drops of 10 per cent. neutral ferric chloride added. If acetic acid be present, a deep red color results. The acid may also be discovered by heating the contents with alcohol and sulphuric acid; the ethyl ester is formed, which can be recognized by the odor. When acetic acid is present in pathological amount, it can be recognized in the odor of the contents.

SUMMARY.

In summary, the chemical analysis of the gastric contents is conducted as follows:

(1) Reaction tested with litmus.

(2) Free acid is tested for Congo red.

(3) Test for free HCl with phloroglucin-vanillin. If negative or doubtful with this reagent, test with Boas reagent, 00 tropeolin, Töpfer's reagent.

(4) Test for lactic acid, De Jong method.

(5) Test for butyric acid.

(6) Test for acetic acid.

(7) Measure off 10 c.c. of the mixed contents; to this add 2 to 3 drops of phenothalein. To this mixture add decinormal soda-solution from a burette, testing a drop of mixture for free HCl by phloroglucin-vanillin after each addition of the soda. When a drop fails to give the Gunzberg test, record the reading of the decinormal solution present when the test was last obtained for the reading for total free HCl. Continue to add the decinormal solution to the same mixture, testing a drop after each addition with Congo-red paper for free acids and acid salts. Note the reading when the Congo red ceases to give even a slight brown color. At this point test a drop of the mixture with a drop of ¼ per cent. aqueous solution of alizarin. Continue adding the decinormal solution until a drop of mixture gives a pinkish-purple color with alizarin. Take the reading for the estimation of the total free acids and acid salts (*B*).

Where this alizarin test works, it is to be used as the index of these substances, the Congo test being simply an adjuvatant test. The alizarin test is, as a rule, from $\frac{1}{10}$ to $\frac{2}{10}$ of a cubic centimetre

decinormal soda-solution more delicate than the Congo (·036 to ·072 gramme per mille). In many cases the alizarin test is not clear, and in such cases the Congo test must be relied upon. (See last number of this JOURNAL, page 38).

Continue to add decinormal solution until a pinkish-red color appears permanently in the mixture. The reading at this point indicates the total acidity (*A*). Subtract *B* from *A* = total combined acid (*C*). Add *D* to *C* = total secreted HCl (*E*). Subtract *D* from *B* = total organic acids *plus* acid salts (*F*). Repeat this analysis to this point with a fresh portion of contents.

(8) Test 10 c.c. of the contents for acid salts by Leo's method. Estimate free acids *plus* acid salts in 10 c.c. of contents after the addition of 1 gramme calcium carbonate (see page 41). Subtract total acid salts (*G*) from *this* estimate of the total free acids *plus* acid salts (B_2) = total free acids (*H*). Subtract total free HCl (*D*) from total free acids (*H*) = total organic acids (*K*).

(9) Place 50 milligrammes of coagulated white of egg in 25 c.c. filtrate of contents at 40° C., and record time of disappearance of egg.

(10) Test for rennin and rennet zymogen by the tests given on page 44).

(11) If free HCl be absent, test for pepsin by the Hammerschlag method (page 43).

(12) If free HCl be absent, estimate the total combined HCl by the Mintz method (page 36).

The record for the second analysis for quantitative estimation of the total acidity, total for HCl, etc., may be taken as the final record. The quantitative tests for each of these substances may be made in separate portions of contents, if desired.

This is a summary of the complete chemical analysis of the gastric contents, as far as such analysis is suited to chemical work. It is unnnecessary, in many cases, to apply the complete analysis.

If a given contents shows free HCl present, no lactic acid, normal total acidity, and a normal period of digestion of the egg albumin, it is, as a rule, safe to conclude that no abnormality which can be discovered by further chemical analysis is present. At the same time a more complete insight into the particular condition of the digestive apparatus in such cases may frequently be obtained by the estimation of the separate acid factors or the full analysis. Where

the qualitative tests or the total acidity are abnormal further analysis is absolutely necessary—as the estimation of the amounts of separate acid factors and of the ferments.

II. RECORD OF THE ANALYSES OF THE GASTRIC CONTENTS OF FIFTY HEALTHY INDIVIDUALS.

The characteristics of the normal gastric contents, as investigated by the method described, have been, to some extent, outlined in the description of the method. Stated collectively, these characteristics are as follows:

Gastric contents expressed one hour after Ewald breakfast.

Total quantity of mixed contents, 36 to 200 c.c.

Total quantity of filtrate contents, 20 to 140 c.c.

Free hydrochloric acid, present.

Lactic acid, absent.

Butyric acid, absent.

Acetic acid, absent.

Proteids. Native proteids (albumin or globulin) are, as a rule, present in the filtrate in very slight traces. Acid albumin, present. Albumoses and peptones, present.

Carbohydrates. Starch is, as a rule, absent in the filtrate, but may be present. Erethrodextrin is frequently present. Dextrin and sugars are, in a majority of cases, the only carbohydrates present in the filtrate.

Total acidity of contents, 1·50 to 3 grammes per mille.

Total hydrochloric acid, 1·15 to 2·48 grammes per mille.

Total combined hydrochloric acid, 0·24 to 1·49 grammes per mille.

Total organic acids and acid salts, 0·20 to 0·88 grammes per mille.

Total free hydrochloric acid, 0·1 to 1·90 grammes per mille. Mean 1·12.

Period necessary to digest 0·005 gramme of coagulated egg albumin in 25 c.c. of contents, 2 to 3½ hours.

Pepsin present. Quantity, 80 to 90 per cent. Hammerschlag method (page 43).

Rennin present. Quantity, one-twelfth to one-fortieth dilution.

Rennet zymogen, present. Quantity, one-sixtieth to one one-hundred fiftieth dilution (by Friedenwald's tables, referred to on page 44).

The data just given are taken directly from the collected results

of a series of investigations of the normal digestion which I have this year conducted at the Harvard Medical School.[74] The subjects of the investigation were healthy young men between the ages of seventeen and thirty years, students at the school. The number of individuals examined was fifty. Such cases only were taken as had no symptoms of digestive disturbance at the time of examination, and no history of chronic or intermittent dyspepsia.

The investigation was conducted in the following manner: Each man took an Ewald test breakfast, consisting of one baker's roll and 300 c.c. of water in the morning, after a fast of twelve hours. One hour later the stomach-tube was passed and the gastric contents expressed by the Ewald method (page 32). The expressed contents were then subjected to an investigation after the method described in this paper, summarized on page

In each of the fifty cases the following determinations were made:

(1) Total quantity of mixed contents.
(2) Total filtrate.
(3) Presence of free hydrochloric acid.
(4) Presence of lactic acid.
(5) Total acidity.
(6) Total hydrochloric acid.
(7) Total free hydrochloric acid.
(8) Total combined hydrochloric acid.
(9) Total organic acids and acid salts.
(10) Presence of starch, of erethrodextrin, of dextrin.
(11) Presence of native proteids, of acid albumin, of albumoses or peptones.

In each of fifteen cases, in addition to the above, these determinations were made:

(12) Presence of butyric acid.
(13) Presence of acetic acid.
(14) Period necessary to dissolve 5 milligrammes of coagulated egg albumin in 25 c.c. of filtrate of contents at 40° C.
(15) Total amount of acid salts.
(16) Total organic acid.

The scheme employed in the analyses was that given in the summary of the method on page 98.

[74] The data in regard to the pepsin and the rennin must be excepted from this statement. These are taken from the observations referred to on pages 43 and 44 of the last number.

In testing for free HCl, all four of the reagents mentioned in the detail of the method were used in order to test their relative delicacy and applicability.

The test used for lactic acid was the De Jong test.

The much-used Uffleman test, as also the Penzolt modification of this, were both used in each case, in order to test the relative accuracy of these tests by the De Jong.

The quantitative estimations were made in each case both upon the mixed contents and upon the filtrates. The method used in the quantitative work is that detailed in the description as the color-analysis method (page 37).

It is clear that the results obtained in this way are of value chiefly for comparative work. For example, the estimation of the total free hydrochloric acid is slightly less than the actual amount present, as the limits of the Gunzberg reaction test are at best, 0·05 gramme per mille. In the estimation of the total organic acids *plus* acid salts, by the subtraction of the total free hydrochloric acid from the total free acids *plus* acid salts, this 0·05 gramme per mille of HCl must therefore be included in the total of organic acids *plus* acid salts, making this total slightly too high. But such an error in the absolute amounts does not affect the value of the results for comparative work, since this error is a constant in all results obtained by this method.

The results in the fifty cases fall within regular and fairly circumscribed limits admitting of a definite classification.

The qualitative results, as regards the mineral and organic acids, are absolutely regular.

The quantitative results show a fairly wide range of variation in the different cases; excepting in one case (Case 17), however, these results correspond to a definite type.

The summary of results in the cases is as follows:

(1) Total quantity of contents: mean, 110 c.c.; minimum, 35 c.c.; maximum, 220 c.c. Twenty-five cases gave a quantity of 100 c.c. or more.

(2) Total quantity of filtrate: mean, 110 c.c.; minimum, 20 c.c.; maximum, 140 c.c. Eight cases gave 100 c.c. or more.

(3) Free hydrochloric acid. Present in all cases.

(4) Lactic acid. Present in no case.

The Uffleman test was obtained from the crude filtrate in eight cases.

The Uffleman test was obtained in the ethereal extract of the contents (Uffleman-Penzolt test)[75] in two cases, both of which had given the test in the crude filtrate. The De Jong test was obtained in no case. This would indicate that there were present in the contents in eight cases substances not lactic acid, which, to some extent, simulated the test for this substance in the filtrate. In two cases only were these substances soluble in ether.

Butyric acid; present in no case (15 cases).

Acetic acid; present in no case (15 cases).

Proteids; native proteids; present in slight trace in 46 cases.

Acid albumin; present in all cases in filtrate.

Albumoses or peptones (Biuret reaction); present in all cases.

Carbohydrate; starch present in six cases in filtrate; erethrodextrin present in 15 cases; dextrin present in 27 cases.

QUANTITATIVE ESTIMATIONS.

MIXED CONTENTS.

	Mean. per Mille. Grammes.	Max. per Mille. Grammes.	Min. per Mille. Grammes.
Total acidity of mixed contents	2.18	3.00	1.50
Total hydrochloric acid	1.66	2.48	1.15
Total free hydrochloric acid[76]	1.12	1.90	0.09
Total combined hydrochloric acid[76]	0.57	1.49	0.24
Total organic acids and acid salts	0.59	0.88	0.20
Total organic acids (15 cases)	0.45	0.61	0.15
Total acid salts (15 cases)	0.14	0.27	0.08

FILTRATE.

Total acidity of filtrate	2.04
Total hydrochloric acid	1.48
Total free hydrochloric acid	1.07
Total combined hydrochloric acid	0.41
Total organic acids and acid salts	0.56

A comparison of the quantitative results of the mixed contents and the filtrates shows, as you see, a lower average total acidity in

[75] *Deutsches Archiv. f. klin. Med.*, 1893–94.

[76] This low record of free HCl was found in one case (Case 17). The next lowest record was 1 gramme per mille. This Case 17 also gave the high combined acid record 1.39 grammes per mille; also the highest difference between contents and filtrate 1.23 grammes per mille. The total acidity and the qualitative results were normal. I have records of several pathological cases with a low free HCl like this case, which were relieved by administration of HCl. So low a record is not therefore always normal.

the filtrates. This difference appears from the results to be due principally to the smaller amount of combined acids which are present in the filtrates, the free acids, both mineral and organic, being practically the same in both contents and filtrates.

In several cases the total acidity of the contents and filtrates was the same; in all other cases the filtrate total was less. In one case the difference of the total acidity of contents and filtrate was 1·33 grammes per mille; in one case 0·56 per mille; in all other cases it was less than this. These examples serve to demonstrate the necessity of performing the quantitative tests with the mixed contents and not with the filtrates, as has been advised by several investigators. On this point my results are in accord with those of Martius and Luttke in their investigations of this subject.[77] The work of these authors shows, in addition, that different filtrates from the same contents give varying results.

The results of the investigation in individual cases may be seen in the following analysis, which I have taken from the fifty analyses:

Case I.—Total quantity of mixed contents, 150 c.c.

Free hydrochloric acid, present.

Lactic acid, absent.

Butyric acid, absent.

Acetic acid, absent.

Albumin, slight trace; acid albumin, albumoses or peptone, present.

Starch, absent, erethrodextrin, present.

Total acidity, 2·47 grammes per mille.

Total hydrochloric acid, 2·03 grammes per mille.

Total free hydrochloric acid, 1·37 grammes per mille.

Total combined hydrochloric acid, 0·66 gramme per mille.

Total organic acids, 0·35 gramme per mille.

Total acid salts, 0·11 gramme per mille.

Total quantity of filtrate, 105 c.c.

Total acidity (filtrate) 2·30 grammes per mille.

Total free hydrochloric acid, 1·37 grammes per mille.

Total combined hydrochloric acid, 0·40 gramme per mille.

Total organic acids, 0·40 gramme per mille.

[77] Martius u. Luttke, Magensaure d. Menschen, *loc. cit.* See also on this subject Giegle u. Blas, *Zeitschr. f. klin. Med.*, Bd. XX; and Ewald, *Zeitschr. f. klin. Med.*, Bd. XX.

Total acid salts, 0·10 gramme per mille.

Period necessary to dissolve 0·005 gramme coagulated egg albumin in 25 c.c. of filtrate at 40° C., 2½ hours.

Case II.—Total quantity mixed contents, 205 c.c.

Free hydrochloric acid, present.

Lactic, butyric, acetic acid, absent.

Albumin, present.

Starch and erethrodextrin, absent. Achrodextrin, present.

Total acidity, 2·54 grammes per mille.

Total hydrochloric acid, 1·82 grammes per mille.

Total free hydrochloric acid, 1·15 grammes per mille.

Total combined hydrochloric acid, 0·67 gramme per mille.

Total organic acids, 0·49 gramme per mille.

Total acid salts, 0·27 gramme per mille.

Total quantity filtrate, 135 c.c.

Total acidity, 1·98 grammes per mille.

Total free hydrochloric acid, 1·20 grammes per mille.

Total combined hydrochloric acid, 0·22 gramme per mille.

Total organic acids, 0·37 gramme per mille.

Total acid salts, 0·19 gramme per mille.

Period of dissolution of egg albumin, 2¾ hours.

Case III.—Total quantity mixed contents, 55 c.c.

Free hydrochloric acid, present.

Lactic acid absent; lactic-acid test obtained in this case by Uffleman test on crude filtrate also in ethereal extract of contents (Uffleman-Penzolt), but not by De Jong method.

Butyric and acetic acid, absent.

Albumin, present.

Starch, present.

Total acidity, 2·18 grammes per mille.

Total hydrochloric acid, 1·38 grammes per mille.

Total free hydrochloric acid, 1·06 grammes per mille,

Total combined hydrochloric acid, 0·32 gramme per mille.

Total organic acid, 0·64 gramme per mille.

Total acid salts, 0·16 gramme per mille.

Total quantity filtrate, 28 c.c.

Total acidity, 2·03 grammes per mille.

Total free hydrochloric acid, 0·95 gramme per mille.

Total combined hydrochloric acid, 0·32 gramme per mille.

Total organic acid, 0·60 gramme per mille.
Total acid salts, 0·16 gramme per mille.
Case IV.—Total quantity mixed contents, 128 c.c.
Free hydrochloric acid, present.
Lactic acid, butyric and acetic acid, absent.
Albumin, absent.
Starch and erethrodextrin, absent; achrodextrin, present.
Total quantity filtrate contents, 50 c.c.
Total acidity, 1·72 grammes per mille.
Total hydrochloric acid, 1·31 grammes per mille.
Total free hydrochloric acid, 0·87 gramme per mille.
Total combined hydrochloric acid, 0·44 gramme per mille.
Total organic acids and acid salts, 0·41 gramme per mille.
Period of dissolution of egg albumin, 3½ hours.
Case V.—Total quantity mixed contents, 60 c.c.
Free hydrochloric acid, present.
Lactic acid, absent. Test obtained in crude filtrate with Uffleman's test, but not in ethereal extract or De Jong test.
Albumin, present.
Erethrodextrin, present.
Total quantity filtrate, 35 c.c.
Total acidity, 2·16 grammes per mille.
Total hydrochloric acid, 1·61 grammes per mille.
Total free hydrochloric acid, 1·37 grammes per mille.
Total combined hydrochloric acid, 0·66 gramme per mille.
Total organic acids and acid salts, 0·55 gramme per mille.
Case XVII.—Total quantity mixed contents, 60 c.c.
Free hydrochloric acid, present.
Lactic, butyric and acetic acid, absent by all methods.
Albumin, present; albumoses or peptones, present.
Achrodextrin, present.
Total acidity, 2·12 grammes per mille.
Total hydrochloric acid, 1·58 grammes per mille.
Total free hydrochloric acid, 0·09 gramme per mille.
Total combined hydrochloric acid, 1·40 grammes per mille.
Total organic acids and acid salts, 0·53 gramme per mille.
Total quantity filtrate contents, 25 c.c.
Total acidity, 0·79 gramme per mille.
Total free hydrochloric acid, 0·07 gramme per mille.

Total combined hydrochloric acid, 0·21 gramme per mille.

Total organic acids and acid salts, 0·51 gramme per mille.

A comparison of these results with those of other investigators shows a general agreement, except in regard to two conditions. These conditions are:

(1) The total quantity of gastric contents.

(2) The condition of the carbohydrate digestion in the stomach.

The total quantity of the gastric contents expressed one hour after the ingestion of an Ewald test breakfast from the normal stomach is placed by most writers on the subject of gastric disease as lying between 25 and 60 c.c. (Rosenheim, 25 to 60 c.c.; Leo, 25 to 60 c.c.; Hammerschlag, 30 to 40 c.c.).[78]

I have been unable to find any report of any definite sets of observations to serve as a basis for this generally accepted statement. The results are undoubtedly taken from the large number of cases these observers have examined in clinical work.

These writers say further, that a quantity of expressed contents of over 100 c.c. in a given case is suggestive of some affection of the motility of the stomach or of stenosis of the pylorus.

Boas states in his text-book that the total quantity of the filtrate upon the contents obtained one hour after the Ewald breakfast averages 40 c.c. in the normal stomach. The normal limits he places as 15 c.c. each way.[79]

He gives as the basis of his statement the results of the investigation of eight cases.

The results in the fifty cases which I have investigated are as follows:

The total quantity of the mixed contents expressed one hour after the Ewald test breakfast averaged 110 c.c.

The minimum amount was 35 c.c.

The maximum amount was 205 c.c.

Twenty-five cases showed a quantity of over 100 c.c.[80]

The total quantity of the filtrate averaged 66 c.c.

The minimum was 20 c.c.; the maximum, 140 c.c.

Eight cases showed a total filtrate of 100 c.c. or more.

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[78] See reference to Rosenheim, Leo, Hammerschlag, in last number.

[79] Boas: Diagnostik, *loc. cit.*

[80] These high amounts were obtained two and three times in the same individual.

These results differ considerably from those of Boas and from the statements of the other writers upon the subject.

They increase the limits of the normal variation and definitely contradict the conclusion that a total quantity, or even a total filtrate of the gastric contents of over 100 c.c. is indicative or suggestive of some pathological condition.

In regard to the condition of carbohydrate digestion in the normal stomach, the conclusion given by Ewald in his text-book is confirmed or acquiesced in, in practically all the text-books upon the subject.[81] Ewald's conclusion is that in the filtrate of the gastric contents expressed one hour after the Ewald test breakfast from the normal stomach, the starch is all transformed to achrodextrin. The presence of a blue color with the iodine test (starch) or a purple color (erethrodextrin), he considers indicative of hyperacidity of the contents.

In the fifty cases which I investigated, starch was present in the filtrate in six cases, erethrodextrin in fifteen cases, achrodextrin in twenty-seven cases.

The evidence of these results warrants the conclusion that erethrodextrin, or even starch, may be present in the filtrate of the contents of the normal stomach one hour after the Ewald test breakfast.

In regard to the qualitative results for free hydrochloric and for organic acids, all authors are in agreement.

In regard to the quantitative results there is practical agreement. Thus for total acidity we get the following set of figures:

TOTAL ACIDITY.

Ewald[81]	1·30 to 2·40
Leo[78]	0·73 to 2·19
Friedenwald[82]	1·40 to 2·29
Hewes	1·50 to 3·00

FOR TOTAL FREE HYDROCHLORIC ACID.

Mintz[83]	0·50 to 1·00
Friedenwald[82]	1·39 to 1·75
Hewes	0·10 to 1·90

For the test of digestive capacity with egg albumin Jaworski found that 5 milligrammes of coagulated egg albumin dissolved in

[81] Ewald: *Klinik der Verdauungskrankheiten*, 1891, s. 51.
[82] Friedenwald: *Medical News*, June 22, 1895.
[83] Mintz: *Wiener klin. Woch.*, Bd. XX, 1889. Bd. IX, 1891.

25 c.c. of filtrate of normal gastric contents in two or three hours at 40° C.

In considering these results in my case two facts must be borne in mind: (1) that the results were obtained exclusively upon healthy young men; (2) that the individuals utilized were all accustomed to partake of a hearty American breakfast at the hour at which they took the test meal.

In what way and to what extent these facts have influenced the results, it is impossible to determine. It is probable, however, that results obtained from individuals of all ages and both sexes would differ somewhat from these.[84]

These results were obtained upon individuals many of whom had never experienced the passing of the stomach tube. Some observers consider results obtained at the first passage of the tube as inaccurate, owing to the effect of the experience upon the nervous-control system of the patient. I have examined the contents obtained from these same individuals on subsequent occasions, in a considerable number of cases, and found the general averages and limits the same.

When all is said, however, data of this kind can be used as control data in a general way. For, as is well known in matters of physiological function, each individual is, to a certain extent, a law unto himself.

TREATMENT OF MORPHINE POISONING BY POTASSIUM PERMANGANATE.

By L. E. Sayre.

Two cases of successful treatment of morphine poisoning by the use of permanganate of potassium have come within my observation within the past few years, one of them quite recently. I should not consider it worth while to report these, were I not aware that there are many who were skeptical as to the antidotal value of potassium permanganate. I believe it has been nearly four years since Dr. William Moor (*Medical Record*, 1894) claimed this salt to be a new antidote for morphine.

Shortly after Dr. Moor's announcement was made, a case of morphine poisoning was brought to my notice, where immediate action

[84] Abstract in Boston *Journal of Medical Sciences*, No. 11, 1897.

was necessary to save life. The patient had taken five capsules, one grain each, of what was supposed to be quinine, but was actually morphine sulphate. It may be stated that the young lady had filled the capsules herself from a bottle properly labelled, but through carelessness had not observed that it was not quinine. When the mistake was discovered, a messenger was sent to my laboratory asking for an antidote and for my assistance. A physician, Dr. F. D. Morse, was telephoned for, and an aqueous solution of permanganate of potassium was dispensed with proper directions; this was immediately administered. It was then 1 P. M. The poisonous effect of morphine at the time of the administration of the antidote was very apparent, it having been four hours since the full quantity of the morphine had been taken. At about 1.30 P.M. the physician arrived and administered hypodermically atropine $\frac{1}{100}$ grain; then a concentrated infusion of coffee was administered at short intervals. An emetic of mustard soon produced an evacuation of the stomach. After emesis had been established by the mustard, the coffee infusion could not be retained for any length of time upon the stomach. A hypodermic injection of strychnine sulphate $\frac{1}{60}$ grain was given in the course of a half hour, followed in an hour by $\frac{1}{60}$ grain of the same salt. By six o'clock in the evening the patient was allowed to have a short nap, from which she was easily aroused in twenty minutes. The pupils of the eye began to dilate, and at 9 P. M. she was considered entirely out of danger, and was able to enjoy the rest of the evening at a game of cards.

A still more remarkable case of morphine poisoning happened here on the 6th of January. A drachm bottle of morphine had been purchased and about thirty grains of this had been taken; first dose at 2.20 P. M. When Dr. Morse arrived, at 4 P. M., the patient was fully under the influence of the morphine. A 5-grain tablet of potassium permanganate was dissolved in water, and the patient was required to take as much of this as possible at once; this was followed by a hypodermic injection of apomorphine $\frac{1}{10}$ grain; this was administered at 4.15 P. M. The permanganate solution as it was expelled from the stomach (emesis soon being experienced) was wholly decomposed; $\frac{1}{100}$ grain of atropine sulphate was now administered hypodermically, and more permanganate solution given. This was retained but a short time, and was not decolorized when expelled from the stomach. Twenty minutes after-

ward $\frac{1}{30}$ grain of strychnine sulphate was administered hypodermically and, at 4.50, $\frac{1}{100}$ grain of atropine sulphate, and at 5.15 $\frac{1}{30}$ grain of strychnine sulphate similarly administered. Infusion of coffee was now given, this acting as an emetic. At 9 and 12 P. M. strychnine $\frac{1}{60}$ grain, *per orem*, was repeated. Patient was kept walking. After midnight, 1.30 A. M., the patient had some difficulty in breathing, but this symptom passed off gradually, and at 4 A. M. the patient was allowed to sleep. By 7 o'clock the next morning the patient was considered out of danger, and was left in care of family.

While the above cases do not prove conclusively that the permanganate of potassium was the one agent which produced antidotal effect, the physician above mentioned seems confident that, had he not administered the permanganate solution in the above cases, he would in all probability have lost these patients.

GLEANINGS FROM THE MEDICAL JOURNALS.

By Clement B. Lowe.

Dr. John C. Sundberg writes a very interesting letter to the *Journal of the American Medical Association* about "Asiatic Plagues and Cholera Centres." One item of it should be given a wide circulation. He says: "There are three very holy cities in this region where good Shiah Mahommedans choose to be buried, and thus it happens that some eight or ten thousand defunct immigrants, some of whom have been dead two or three years, pass annually through Bagdad on the way to their final resting-place. The coffins being leaky, putrid cadaveric liquid pours out through the seams and drops on the road, to there dry and scent the dust. Thus one smells the approach of a funeral caravan, with its three or four hundred corpses, for miles to leeward. They come mostly from Persia, and bring also with them great loads of the finest Persian carpets and rugs. From Bagdad these rugs, which have, perhaps, for twenty or more years been exposed, in inconceivably filthy homes, to the contagion of every known disease germ and other abominations, are now shipped to Europe and America, to henceforth adorn the parlors of the rich and undermine the health and shorten the lives of their children. Let the quarantine authorities take due notice thereof, and govern themselves accordingly."

The danger of self-medication was recently exemplified by the case of a woman who died in Brooklyn, N. Y., after taking a number of pills containing belladonna and strychnine. The woman, who was suffering from indigestion, received the pills from a young woman employed in a wholesale drug house in New York City, and was told by her to take one after each meal. Death was due to an overdose. —*New York Medical Journal*, December 11, 1897.

A PRESCRIPTION FOR GASTRIC ACIDITY.

Boas (cited in the *Journal de Medicine de Paris* for October 3d) recommends the following :

℞	Sodium sulphate,	30 parts.
	Potassium "	5 "
	Sodium chloride,	30 "
	" carbonate,	25 "
	" biborate,	10 "

℥.—S. : Half a teaspoonful, in half a glass of warm water, three times a day, two hours before eating.

PLAGUE ATTACKS MONKEYS.

The bubonic plague, which is still raging in British India, has attacked a colony of monkeys near Hardwar. The local authorities are trapping and isolating the diseased animals.

ACCIDENT INSURANCE FOR STUDENTS.

At the University of Heidelberg all students doing laboratory work, and even those who attend experimental lectures in chemistry or physics, are required to take out an accident insurance policy covering casualities which are liable to occur in such institutions. Students who are unfortunate enough to be entirely disabled are to receive $500 per annum, with a corresponding allowance for lesser injuries. The premium, however, is low—but two and a half cents for lecture courses per semester.

TYPHOID FEVER AND CERTAIN GAMES.

An English practitioner, in writing to the *Lancet*, refers to the fact that many cases of typhoid fever occur in the autumn, and attributes the cause of the disease to games, such as marbles and peg-top, which are played in the street at this time of the year, after the cricket season is over. In playing marbles a boy frequently licks his fingers to prevent the marble slipping, and the whip-cord of a top is wet in the mouth for the same reason. In this way the germs are conveyed into the alimentary tract. The writer's theory

is borne out by the fact that the disease almost exclusively affects boys.

IVY POISONING.

Schonberg (*Philadelphia Polyclinic*, October 16, 1897) says that none of the remedies used in the treatment of ivy poisoning are specifics. All of them are designed to relieve the itching and burning and subdue the inflammation. Of almost equal value are: (1) saturated solution of boric acid; (2) fluid extract of Grindelia robusta, 1 drachm to 4 ounces of water; (3) aqueous solution of sodium hyposulphite, 1 drachm to the ounce; (4) Labarraque's solution, 25 to 50 per cent.; (5) black wash, diluted one-half with lime water; (6) bromine, 10–15 minims to 1 ounce of olive oil.

IRON BEER.

Jaworski has a beer containing iron, made at the Bukownia brewery, which he has found extremely beneficial in certain cases. The iron is readily absorbed in this form, the taste disguised, while the beverage is nutritious, containing more calorics than an equal amount of milk. It is a dark bock beer, composed of 4·07 per cent. alcohol; 8·03 per cent. extracted matters; oxygen, 0·21 per cent., and 0·0317 iron in the weaker; 0·0644 in the stronger beer. The hæmoglobin, number of corpuscles and the weight increased after a few days of its use.—*Therap. Woch.*, September 26.

The Use of Manganese in the Treatment of Dysmenorrhœa; with Report of Cases.—Donovan (*Medical News*, November 27, 1897). This is an original article, illustrated with several typical cases, which, apparently, prove that manganese is of great value in the treatment of dysmenorrhœa. It was given in the form of the black oxide, 1 to 5 grains, in pill form, three times a day, after meals. In some cases it was combined with the dried sulphate of iron and extract of nux vomica.

The Administration of Cod Liver Oil.—Bricemoret (cited in the *Journal des Praeticiens* for October 23d) recommends the following formula:

℞ Cod liver oil, 15 ounces.
Syrup of tolu, 7½ "
Tincture of tolu, 12 drops.
Essence of cloves, 2 "

℥.—S.: A tablespoonful two or three times a day, the bottle being well shaken before the dose is poured out.

Influence of Alcoholism in the Father upon the Life of the Child.—Anthony (*Centrabl. für Gynækol.*, October 16, 1897) mentions a case of a healthy woman who was married at the age of seventeen years to a notorious drunkard, and who had by him, in her nine years of married life, five miserable little children, of whom four died within the first ten days after birth. The fifth one, by great care, was raised to the fourth year, when it also died. After this the woman was separated from her husband. She then married a healthy man, and had by him two children, the elder of whom grew to be four years old, and the younger, at the time of writing, was fourteen days old. Both were in perfect health. This great contrast between the children of different fathers plainly shows, inasmuch as syphilis was not present, that the alcoholism of the father of the first children destroyed their vitality.

Healthfulness of Cycling.—After a prolonged consideration of the subject, the Paris Medical Society has come to the conclusion that cycling is excellent exercise for healthy people, is very beneficial for those suffering from nervous disorders, but is undesirable for delicate people, who are liable to suffer from over-fatigue.—(*Medical News*, December 4, 1897.)

Ichthyol in the Treatment of Smallpox.—Cassenko (*Therapeutic Gazette*, November, 1897) recommends ichthyol as a local application in variola. The remedy was used as an ointment, made as follows:

℞	Ichthyol,	10 parts.
	Fat,	60 "
	Lanolin,	20 "

The lanolin may be replaced by chloroform, olive oil, glycerin, or the like, according to the individual case. The ointment was rubbed in three times a day as soon as the papules became visible. As a result, there was little or no tenderness at the seats of eruption, the temperature never rose high, and the desquamation was almost completed in three or four days from the maturation of the eruption (half the usual duration).

RECENT LITERATURE RELATING TO PHARMACY.

SPINDLE TREE (EUONYMUS EUROPÆUS, L.).

The spindle tree (Euonymus Europæus) is one of our native shrubs or small trees possessing great ornamental merit, which is overlooked by landscape gardeners. It is deciduous, but its broadly lanceolate leaves, of a wavy, irregular outline, with minutely serrated edges, turn, before they fall, to a deep, rich crimson. The small pale-green cross-like blossoms, which open in May, are inconspicuous; but the fruit, when ripe in October, has all the appearance of a flower of brilliant hues. The fruit, indeed, from its color and shape, is the most distinctive as well as most beautiful feature of the tree. Each berry is four-lobed and of a lively rose-pink. When quite ripe the lobes open, disclosing four large seeds covered with a deep orange-colored membrane, the seeds and the husk then presenting a curious but attractive contrast. The wood of the spindle tree is exceedingly tough, and the husks and stems of the berries partake of the same character, so that long after the leaves have fallen these remain to enliven the wintry landscape. Birds will not touch them, and with human beings they act as a strong emetic and purgative.

The wood is so compact and tough that it is hard to break and almost impossible to splinter. In the days of domestic industries, when every notable maid minded her wheel, it was in request for the making of spindles; hence its commonest name—a name by which it is known in Germany and Italy. It was also used for making the pointed ends of ox-goads, whence is derived another name of gatter tree, or prickwood. Chaucer calls the berries gaitre-berries, and in the Nonnes Preetes Tale recommends them against ague and the humors[1]. In Ireland it is called pegwood, because shoemakers use it for pegs for shoes. In France it is also known by the name of priest's cap, from the resemblance of the berry in shape to a biretta. Though goads and spindles are gone out of fashion, the wood is still employed in the making of a variety of small wares, such as skewers, toothpicks and fine pins for cleaning watches; and artists are said to prefer the charcoal prepared from the branches to any other, partly from its excellent quality and partly because it is easily effaced.

[1]Chaucer's plant is, however, generally supposed to be dogwood (Cornus sanguinea, K.).

The spindle tree is easily propagated either from seed or from cuttings. It seems to prefer a chalky soil and a mild climate, and consequently flourishes best in the southern counties of England. It is said to be rare in Wales; in Scotland it is almost unknown. A variety of the common spindle tree, bearing berries with white instead of pink husks, is occasionally found; but although the contrast between the white husks and the orange seeds is curious, the effect is less pleasing than that presented by the berries of the commoner sort.—*Kew Bulletin.*

BISABOL MYRRH.

Tucholka gives the following method for distinguishing between bisabol myrrh and the official drug: Six drops of petroleum ether extract (1 to 15) are mixed with 3 c.c. of acetic acid, and 3 c.c. of sulphuric acid added so as to form a lower layer. A rose-red color is developed at the line of contact, and after a short time the whole of the acetic acid layer is colored red, remaining so for some time. If the petroleum ether extract is more concentrated, the resulting color is brown. The official myrrh, treated with this reagent, gives only a slight rose coloration of the acid layer, which does not increase; the contact line of both fluids is first green, changing on standing to brown, with a greenish fluorescence. An analysis of bisabol myrrh gave: Gum soluble in water, 22·1; gum soluble in soda solution, 29·85; resin, 21·5; bitter principle, 1·5; ethereal oil, 7·8; water, 3·17; vegetable and inorganic matter, 13·4. The ethereal oil gave the above distinctive color reaction very markedly. By means of a modification of Wallach's method for the preparation of the hydrochloride of the terpenes, small, well-formed, tablet-shaped crystals, melting at 79·3, were obtained. The author calls this product "Bisabolene;" he is unable to identify it with any known terpene. It has the unusually high boiling point of 260° C. The red oil from which the crystalline hydrochloride was separated, when fractionated between 230° to 239°, gave the characteristic color reaction. The oil, no doubt, also contains alcoholic ester-like compounds, since benzoyl chloride reacts very violently with it on gentle heating. The resin removed by alcohol has a strong acid reaction. Two distinct acids were obtained, one of which furnished a soluble, and the other an insoluble lead salt.—*Pharm. Centr.*, xxxviii, 500, through *Pharmaceutical Journal.*

FORMALDEHYDE AS A DISINFECTANT.

In a communication to *The New York Medical Journal*, in its issue of October 16th, Alvah H. Doty, M.D., health officer of the port of New York, gives the results of a series of elaborate and carefully-conducted experiments, which were begun about a year ago and continued until the present time, in the New York Quarantine Station, for the purpose of ascertaining the value of formaldehyde as a disinfectant.

The tests were made with the view of ascertaining the penetrating action of the gas, as well as its germicidal action upon exposed surfaces; and, in order to accomplish this result, the micro-organisms used were not only exposed directly to the gas, but were placed inside of sterilized blankets, newspapers and other packages before exposure to the disinfectant. And in order to determine its efficiency for quarantine work, pathogenic organisms, which were kept at the highest degree of virulence, were used. These were the cholera, anthrax and diphtheria bacilli, and the bacillus of the plague.

The several sources now available for the production of formaldehyde gas for disinfection were enumerated by the author about as follows:

(1) From a commercial product, known as formaldehyde (formalin, formol), said to be a 40 per cent. solution of formaldehyde gas in water. The exact method of its production is not explained by the manufacturers. It occurs as a clear, colorless fluid, having a characteristic odor and very irritating to the mucous membranes of the eyes and respiratory tract.

(2) From the combination of the above-described formaldehyde solution (formalin) and chloride of calcium placed in a closed receptacle or autoclave. By the application of heat, the gas contained in the autoclave is given off in a dry state and conducted through a tube to the apartment to be disinfected.

(3) The generation of formaldehyde gas by the oxidation of methyl or wood alcohol in a lamp constructed for this purpose.

(4) By the heating of paraformaldehyde in the form of tablets (paraform).

A portion of the experiments were conducted on a disinfecting vessel provided with air-tight chambers. One of these is so constructed that a vacuum can be produced in it before the admission

of the formaldehyde gas, the articles to be disinfected being placed in the chamber before the vacuum is made, so that they will also be deprived of air. The remainder of the tests were made in a room in the laboratory of the quarantine department, which was made expressly for the purpose. It is almost perfectly tight, and is used as a standard in experimental work.

The author stated in conclusion that the results showed that formaldehyde cannot be depended upon for disinfection where deep penetration is required. It can, however, be depended upon to penetrate letters and other thin packages if placed in air-tight chambers. The importance of the vacuum deserves special mention, for, with all the other conditions the same, it was demonstrated that disinfection took place in the vacuum chamber, whereas without the vacuum the germicidal effect was not produced. Packages of the character just described are usually penetrated in a comparatively tight room.

In packages made of blankets, clothing, etc., the action of formaldehyde upon infected discs placed inside is uncertain and not always the same. As a rule, penetration does not occur; at least the organisms are not generally killed. This uncertainty would seem to decide the inefficiency of formaldehyde for deep penetration. For superficial disinfection, *i. e.*, of hangings, furniture, clothing, furs, silks, and other articles, which can be spread out and the surfaces exposed, formaldehyde is an agent of undoubted value, particularly as it does not, as a rule, injure the finest fabrics, and therefore may be safely used in an apartment furnished with delicate paper-hangings and furniture.

In considering the methods proposed for disinfection, the writer said that the use of a formaldehyde solution simply exposed on pans is not to be considered, provided other methods are available. The heating of pastilles of paraformaldehyde is a simple and effective method of securing the gas, although a comparatively expensive one. The lamp for the generation of formaldehyde by the oxidation of methyl alcohol is also an effective method. However, these methods have the disadvantage of being comparatively slow. In the use of the autoclave and the apparatus designed by the author, the formaldehyde is rapidly released and conveyed to the apartment to be treated; and, when this is finished, the instrument, which is operated from the outside, can be removed. In this way the mate-

rial to be treated is subjected to almost the entire volume of gas before any considerable leakage from the room occurs.

In addition the author reported that he had carefully inquired into the effect of the gas upon insects, fowls, guinea-pigs, etc, when these were confined in an apartment during disinfection, and that in no case had death ensued, the time of exposure ranging from three to fifteen hours.

Ceylon Flora.—The untimely death of Dr. Trimen unhappily left his admirable "Handbook to the Flora of Ceylon" in an unfinished state. Two volumes still remain to be written, in addition to the three already published. Sir Joseph Hooker has most generously offered to undertake the preparation of these, and his offer has been accepted by the Government of Ceylon. The necessary materials and specimens have already been received at Kew from the Royal Botanic Garden, Peradeniya. More than thirty years ago Sir Joseph Hooker assisted Dr. Thwaites in his *Enumeratio Plantarum Zeylaniæ.—Kew Bulletin.*

Suggestions for the New Codex.—The various societies of pharmacy throughout France have been asked to contribute suggestions for the revision of the Codex, and a number of them have undertaken the task with much thoroughness. The Paris Society of Pharmacists has gone into the matter very closely, and as the members of the special committee of that body, elected for the purpose of studying the question, are largely composed of pharmacists in business, the suggestions made by them are interesting. They ask for the suppression of a certain number of preparations and substances, adding that although such a measure may appear radical, it seems justified when they are apparently abandoned alike by doctors and the public. Not only are some of them very little used at present, but in certain instances, such as medicinal beer, they are difficult to keep. Among the one hundred and one substances which they suggest should be omitted, are oil of absinthe, antiscorbutic beer, sugar of red cabbage, compound electuary of saffron, jelly of deer's horns, distilled water of elderberries, compound electuary of rhubarb, burnt sponge and sweet oil of eggs, calcined bones, pulp of dates, sugar of walnut, acetate of lime, and extract of lilies of the valley. On the other hand, by way of compensation, the Paris pharmacists draw attention to a number of products which appear to have won the right to a place in the Codex. These amount to about ninety, and include cascara sagrada, kola, glycerophosphate of lime, lanoline, salicylate of mercury, walnut leaves, liquid vaseline, artificial serums; also, silks, catguts, etc., with mode of preparation and sterilization. A table of maximum doses of medicaments is also suggested, as well as antidotes, to be printed after each poisonous substance.—*The Chemist and Druggist.*

EDITORIAL.

MINERAL PRODUCTION OF THE UNITED STATES FOR THE YEAR 1897.

The Engineering and Mining Journal, for January 1st, gives some very interesting statistics showing the production of metals and mineral products for the United States during the year 1897, and makes comparison with the corresponding figures for the year 1896. As many of these figures will interest our readers, we give a transcript of some of the more important ones.

Aluminum.—The production of aluminum in 1897 was 4,000,000 pounds, valued at $1,542,240, against 1,300,000 pounds, valued at $520,000, in 1896.

Barytes.—The production was 27,316 short tons, valued at $109,264, against 21,900 short tons, valued at $87,600, in 1896.

Borax.—The production in 1897 amounted to 18,000,000 pounds, valued at $900,000, against 15,258,014 pounds, valued at $762,900, in 1896.

Bromine.—The production in 1897 amounted to 487,149 pounds, valued at $125,953, against 550,285 pounds, valued at $143,074, in 1896.

Calcium Carbide.—The production in 1897 amounted to 1,925 short tons, valued at $134,750, against 860 short tons, valued at $48,000, in 1896.

Cement.—The production of natural hydraulic cement in 1897 was 7,721,215 barrels of 300 pounds, valued at $4,347,925, against 7,454,611 barrels, valued at $4,353,377, in 1896. The production of Portland cement in 1897 amounted to 2,100,000 barrels of 400 pounds, valued at $3,570,000, against 1,032,654 barrels, valued at $1,170,151, in 1896.

Coal.—The production of anthracite coal in 1897 was 49,537,675 tons, valued at $86,690,931, against 48,855,563 tons, valued at $88,105,837, in 1896. The production of bituminous coal in 1897 was 144,901,331 tons, valued at $118,699,151, against 137,516,631 tons, valued at $115,009,979, in 1896.

Coke.—The production of coke in 1897 was 11,774,273 tons, valued at $21,446,321, against 10,359,584 tons, valued at $17,271,871, in 1896.

Copper.—The production of copper in 1897 was 475,338,340 pounds, valued at $52,478,352, against 467,822,973 pounds, valued at $49,729,582, in 1896. Of the production just given for 1897, 60.5 per cent. was exported, and the remainder used at home. More than one-half the total product is now refined electrolytically.

Gold.—The production of gold for 1897 was 2,685,000 troy ounces, valued at $55,478,352, against 2,558,433 ounces, valued at $52,886,209, in 1896. The most important gold-producing state is now Colorado, which has surpassed California. The gold production of the Klondike is not included in this total, but is credited to Canada.

Iron and Steel.—The production of pig iron in 1897 was 9,491,796 tons, valued at $91,122,970, against 8,623,127 tons, valued at $91,577,619, in 1896. The production of steel was about 6,500,000 tons against 5,582,606 tons in 1896.

Lead.—The production of lead in 1897 was 194,530 short tons, valued at $13,931,348, against 174,792 short tons, valued at $10,381,843, in 1896.

Lead Carbonate (*White Lead*).—The production of white lead in 1897 was 96,197 short tons, valued at $8,657,730, against 95,068 short tons, valued at $7,802,267, in 1896.

Petroleum.—The production of crude petroleum in 1897 was 66,000,000

barrels, valued at $52,734,000, against 61,396,394 barrels, valued at $56,963,137, in 1896.

Phosphate Rock.—The production in 1897 was 890,000 long tons, valued at $2,694,058, against 878,689 long tons, valued at $2,643,706, in 1896.

Salt.—The production of salt (including both evaporated and rock salt) in 1897 amounted to 14,455,788 barrels of 280 pounds, valued at $6,385,750, against 13,354,573 barrels, valued at $5,540,098, in 1896.

Quicksilver.—The production of mercury for 1897 amounted to 26,079 flasks of 76½ pounds, valued at $991,002, against 29,863 flasks, valued at $1,104,997, in 1896.

Silver.—The production for 1897 amounted to 56,117,000 troy ounces, valued at $33,557,955, against 58,488,810 ounces, valued at $39,245,991, in 1896.

Soda (manufactured).—The production for 1897 amounted to 177,000 metric tons, valued at $4,071,000, against 158,975 metric tons, valued at 3,656,425, in 1896.

Sulphur.—The production for 1897 amounted to 1,690 long tons, valued at $34,645, against 2,800 long tons, valued at $64,200, in 1896.

Zinc.—The production for 1897 amounted to 100,103 short tons, valued at $8,247,544, against 77,637 short tons, valued at $6,074,219, in 1896.

Zinc Oxide.—The production of zinc oxide paint in 1897 amounted to 26,275 short tons, valued at $2,102,000, against 16,799 short tons, valued at $1,259,925, in 1896.

S. P. S.

IS THE APOTHECARY SHOP DOOMED?

Under the foregoing title the editor of the *Journal of the American Medical Association*, for December 25, 1897, predicts a gloomy future for the modern pharmacist. Coming from the official organ of the National Association the remarks should, perhaps, receive more than merely passing attention. We cannot believe, however, that the views expressed represent the sentiments of the great number of physicians who constitute the membership of that body. The writer delivers himself with the air of one who has suddenly grasped a new idea, and is in haste to give his discovery to the world. Whereas he has simply restated a very old subject. It is only necessary to consult the proceedings of the numerous pharmaceutical association meetings held during the past dozen years, to be convinced that this subject was long ago exhausted. The aforesaid editor sees commercial extinction for the pharmacists because "the physician has his medicines ready made; his pills, tablets, coal-tar combinations, organic compounds, elixirs, etc., are used as they come from the manufacturer." The "corner drug store" is not in a position to fill prescriptions accurately, because the proprietor, one clerk, and boy are so busy with the numerous other matters in such an establishment. This kind of reasoning puts them into the anomalous position of being too busy to do business. Finally, the following: "Even at present, very few pharmacists do more than act as agents for the wholesale druggist. They buy their tinctures and extracts, pills and plasters already made. Their infusions are water-diluted extracts; their waters are mixed essences. They have not the time nor the means to make their own preparations, and the chances are that the crude drugs they would make them from would be beneath the standard." This quotation does not sound like the leader in a reputable medical journal, but rather reminds us of

the advance "write-up" of a patent medicine in the daily newspaper, in which a tirade against the modern pharmacist is usually a prominent feature, and paves the way for something to follow. We are informed that "their waters are mixed essences," but what are "mixed essences," surely someone has a new method of making aromatic waters, and it should be given publicity at once.

The one matter more than any other which has revolutionized the modern pharmacist was not mentioned by the editorial critic, namely, the decline of the patent medicine. Some fifteen years ago, for commercial reasons, the nostrum was relegated to the back room and the cellar, and at first it was a severe financial blow, but pharmacists are recovering from this blow, and have found they are the better for the loss. With the patent medicine out of the way there is a brighter outlook for the pharmacist than for the physician. The former always had to be resourceful or get out of the business; the latter will find if he dispenses the tablets, pills and plasters of the manufacturer, that the public will soon knew as much as he, and medicate themselves, even if it should be with indifferent success. It is not the true practice of medicine to deal out ready-made tablets any more than it is true pharmacy to hand down nostrums. Everything in this world is in process of evolution. Pharmacy and medicines may change, but they cannot go out of existence.

Acquisitions to the Library of the Philadelphia College of Pharmacy.

In less than two years the Library of the College has acquired by purchase or presentation valuable portions of the libraries of Professors Maisch and Bastin and Dr. W. S. W. Ruschenberger. In the Maisch collection were numerous pamphlets and monographs, which had been received by him from foreign sources, and which it would be very difficult to duplicate. There were also a number of standard works on botany and chemistry, mostly in the German language, which are valuable as works of reference. The portion of Dr. Ruschenberger's library received contained a number of scarce serials, and of older editions of dispensatories, etc., which are of especial interest and value from a historical standpoint.

The latest collection, that of Professor Bastin, consisted of nearly 150 volumes relating almost exclusively to botany and microscopy. Probably the most notable of these are "Dictionaire de Botanique," Baillon, four volumes; Kohler's "Medicinal Pflanger;" "Historie des Plantes Venénenses et Suspectes de France," Bulliard, two volumes; "Atlas Manuel de Botanique," Deniker; "Arboretum et Fructicetum Brittanicum," London, seven volumes; "Botanique Medicale," Baillon; "American Dispensatory," Coxe, 1818. Many of these works are handsomely illustrated.

The Philadelphia Medical Journal.

When the *Medical News* took up its abode in New York, there was felt to be a void in medical literature in this the most renowned medical centre on the American Continent. A half a score of journals proclaimed themselves as individually able to fill the vacancy, but it was apparent that none of them quite "sized up" to the position. The natural outcome was a new medical journal founded by a number of gentlemen representing the leading medical

schools of the city. The first number appeared on New Year's Day, and successive numbers will appear weekly, we trust with constantly increasing prosperity. One can hardly fail to recognize it as the editorial work of Dr. George M. Gould, the former editor of the *Medical News*. His writings possess a certain clear-cut terseness that makes them interesting as well as instructive. This journal purposes "to draw the line against all nostrums in its advertising columns, and we wish it success in this laudable determination, as well as in every other effort towards clean journalism.

NINTH INTERNATIONAL CONGRESS OF HYGIENE AND DEMOGRAPHY.

We have received from the Secretary-General, Prof. Dr. Amalis Gimeno, of Madrid, Spain, the rules, programme, etc., of the exhibition which is to be held concurrently with the Congress at Madrid from the 10th to 17th of April, 1898. The exhibition will be divided into ten classes, as follows: (1) Didactic Hygiene; (2) Prophylaxis of Transmissible Diseases; (3) Urban Hygiene; (4) Hygiene in Relation to Dwelling Houses; (5) Hygiene in What Refers to Exercise and Work; (6) Naval and Military Hygiene; (7) Hygiene of Infancy and Schools; (8) Food and Dressing; (9) Demography and Statistics; (10) Miscellaneous. Those wishing to apply for space should address Dr. Gimeno as above.

REVIEWS AND BIBLIOGRAPHICAL NOTICES.

NOZONI DI ANALISI CHIMICA, E CENNI SULL' ANALISI DELLE ACQUE POTABILI, Del Dott. Icilio Guareschi, Professore ordinario di Chimica Farmaceutica e Tossicologica nella R. Universita di Torino. Unione Tipografico, Editrice, Torino, 1898.

This book of 172 pages is Vol. III, part 2d, of the author's *Commentario della Farmacopea Italiana*. The author is already well-known through his work on the alkaloids, the German translation of which, by Dr. Kunz Krause, was noticed in this JOURNAL during the past year.

The present work is to a certain extent based on the analytical scheme of Fresenius, but it contains many additions which make it of especial value to pharmacists.

After the introduction, there is a section devoted to general considerations in which the behavior of reagents and general operations are thoroughly described and illustrated in the latter case with numerous figures. Part I describes the action of reagents on the salts of the seven groups of bases and on the salts of the inorganic and organic acids. A number of acids are studied which do not usually find a place in books on analytical chemistry.

Part II is devoted to systematic analysis, in which the bases are divided into groups by the usual group reagents, and then separated into individual members. This, however, is prefaced by a preliminary examination in the dry way, and with some directions as to the methods of getting substances into solution. The acids are detected individually, without much attempt to classify them into groups.

A short section is devoted to microchemical analysis, in which a large number of illustrations show the appearance of numerous salts under the microscope; this also includes the appearance of such compounds as starch, inulin,

calcium oxalate, calcium phosphate, aleurone, various coloring matters, etc., in plant tissues.

Finally, Part III is devoted to the analysis of potable water. Nearly all previous writers on this subject receive some consideration at the hands of the author, and the illustrations are well chosen and of a high order, as in all other parts of the book. The estimation of the various gases in water receives careful attention. The whole book is modern, and the bibliographical references are very full. A short biographical sketch of an author quoted is often appended in a foot-note.

ELEMENTS OF LATIN, for Students of Medicine and Pharmacy. By Geo. D. Crothers, A.M., M.D., Teacher of Latin and Greek, St. Joseph (Mo.) High School, and Hiram H. Brice, A.M., Instructor in Latin and Greek, Boys' High School, New York City. The F. A. Davis Company, Philadelphia, New York and Chicago, 1898.

Any book that will aid pharmacists in acquiring a better knowledge of the Latin language should meet with a hearty welcome. The present work is not intended as an introduction to the Latin language and literature, and is therefore only available to those who already have some knowledge of the language. To such, however, it appears capable of serving a good purpose, as it was designed to present, within the briefest possible compass, those principles of Latin etymology and construction which are essential to an intelligent use of the terminology of pharmacy and medicine. The declensions and conjugations are given in an abbreviated form. The chapter devoted to prescription writing contains much that is useful, and some valuable advice is given on the subject of abbreviating Latin names in prescriptions, and a number of examples are given where such practice may lead to serious error. We believe this book should have a place in every prescription department.

DESCRIPTIONS OF THREE NEW SPECIES OF AUSTRALIAN PLANTS. By J. H. Maiden and E. Betche. Reprint from the Proceedings of the Linnean Society of New South Wales, May 26, 1897.

The new species studied and named by the authors are Dodonæ Camfieldi, of the natural order Sapindaceæ; Helipterum microglossum, of the Compositæ, and Leucopogon Fletcheri, of the Epicrideæ.

NOTES FROM THE BOTANIC GARDENS, SYDNEY. By J. H. Maiden and E. Betche. Reprint from the Proceedings of the Linnean Society from New South Wales, May 26, 1897.

This consists of notes on rare Port Jackson plants, and plants from New South Wales.

MINUTES OF COLLEGE MEETING, DECEMBER 27, 1897.

The quarterly meeting of members of the College was held this day at 4 P.M. Charles Bullock presided. Nineteen members registered names. The minutes of the previous stated meeting were read, and, on motion, adopted. The minutes of meetings of the Board of Trustees for October, November and December were read and approved. The Secretary referred to the application which had been made to this College to furnish a draft of proposed uniform

pharmacy law for all the States, and stated that action upon this had been postponed from time to time. The subject being discussed, it was, on motion, resolved to now postpone action indefinitely. Mr. Geo. M. Beringer, chairman, presented the report of the Special Committee appointed to consider the questions in the authority of the College to restrict those members of the Faculty and all others who receive salaries or perquisites for services in their right to vote as members of the Board of Trustees, which question, on its constitutionality, had been formally referred to the Solicitors of the College for a legal opinion, said opinion sustaining this authority. This report, after a calm, deliberate and most impartial consideration of all the phases which the subject presents, concludes with the following preamble and resolution :

WHEREAS, The question of restricting the eligibility of members of the Board of Trustees to such members only as do not receive remuneration for service rendered the College has been under discussion for some time, and the opinion of the Solicitors affirms that such restriction is in the power of the College to adopt, and would be reasonable and valid, and,

WHEREAS, The rapid growth and increase of departments have changed the condition of College management so that we are convinced that the custom brought about by the founders of electing the Faculty to membership in the Board of Trustees is a conservation of force, which, eventually, must prove detrimental to the progress and proper business-like management of this institution. Therefore, be it

Resolved, That we recommend that this custom be discontinued, and that hereafter no member receiving any emolument for services rendered the College be eligible for membership in its Board of Trustees. We would recommend, however, that the conditions of this resolution be not applied to any of the present Trustees.

Report signed by

GEO. M. BERINGER,
EDWIN M. BORING,
CHAS. A. WEIDEMANN,
WILLIAM L. CLIFFE,
F. W. E. STEDEM,
Committee.

On motion being called for in regard to disposition of this report, Dr. Lowe moved its acceptance, and that it be considered open for discussion. The discussion which ensued thereupon was warm and spirited, Dr. Lowe, Mr. Ross, Mr. Beringer, Mr. McIntyre, Mr. Procter, Professor Sadtler, Professor Remington, Mr. Buckman, Mr. Kline, Mr. Chas. A. Heinitsh, Mr. Trimble, Mr. Cliffe, Mr. Ellis and Dr. Weidemann participating. When the chairman put the question upon the adoption of the report, it was negatived by a vote of 18 to 8.

The Secretary read the resignation of a member, and Mr. Kline proposed that action be deferred to enable him to exercise his power of persuasion in inducing him to recall his declination. The reading of a note of regret of Mr. Jos. L. Lemberger, expressing inability to be present, closed the proceedings, and the meeting adjourned.

WILLIAM B. THOMPSON,
Secretary.

NEW YORK COLLEGE OF PHARMACY.

VANILLA.

The meeting of January 18th was devoted to the subject of vanilla. Prof. Rusby introduced the discussion by giving a general account of the distribution and habits of vanilla plants and the cultivation and curing of the bean.

At the present time thirty-three species of vanilla are recognized by the *Index Kewensis*. The New World contributes eighteen species; three from Mexico, five from the West Indies, two from Guiana, three from Brazil, three from Peru, and one each from New Granada and Ecuador. A plant which Dr. Rusby collected in Bolivia may belong to one of the Peruvian species, or it may constitute an additional one. In the Old World fifteen species are known; four from Tropical Africa, three from the East Indies, two from Java, and one each from Ceylon, Sumatra, Bourbon, the Seychelles, the Philippines, and the Malay Peninsula. Dr. Rusby has observed Orchidaceous fruits in another genus, closely related to vanilla, having a strong vanilla odor, evidently due to vanillin. The curing and cultivation of vanilla were illustrated by dried specimens of the plants, by colored lantern slides showing the different stages of curing, the structure of the flowers and the methods of artificial pollenation.

Professor Jelliffe described the microscopical structure of the fruit, and named two species of moulds found on some fruit.

Professor Coblentz followed with a very full resumé of the chemistry of vanillin and the complicated processes connected with its manufacture at different times and by different makers.

The discussion was concluded by Mr. Oscar Kalish, who considered vanilla preparations and their use at the soda fountain. His remarks were illustrated by specimens of extracts carefully prepared according to the several formulas to which he referred.

MINUTES OF THE PHARMACEUTICAL MEETING.

PHILADELPHIA, January 18, 1898.

At the regular monthly Pharmaceutical Meeting of the Philadelphia College of Pharmacy, the Registrar called attention to the very handsome specimen of Kola nuts, both white and red, which has been obtained by Mr. Joseph W. England from Messrs. F. Stearns & Co., of Detroit, Mich. Attention was called to the fact that the color was admirably preserved by the 90 per cent. glycerin. Specimens of quilled Cascara Sagrada of beautiful quality from the same firm were also presented.

Specimens of Malt in powder from Messrs. John Wyeth & Brother were presented. These were prepared in vacuum pans and consequently uninjured by the process of evaporation.

Specimens of Antimony ores were presented by Messrs. McIlvaine Brothers, of Philadelphia.

A lot of railroad iron, asphalt, oakum, etc., weighing some thirty pounds, was exhibited, which had been taken from a case of opium recently received by a Philadelphia importing firm. The steamship company was held liable in this instance for what appeared to be a case of theft or substitution during transportation.

Professor Lowe then introduced Mr. F. B. Kilmer, of New Brunswick, N. J.,

to the meeting. He gave a most interesting account of his trip to the "Land of Ginger"—the Isle of Jamaica. The lecture was illustrated by photographic views thrown upon the screen by the electric lantern, which enabled the speaker to give an admirable and vivid description of the life, homes and land of the growers of ginger, see page 65 of this number.

A vote of thanks was unanimously given to Mr. Kilmer for his lecture.

T. S. WIEGAND,
Registrar.

NOTES AND NEWS.

A New Monthly Journal on Food Products and Allied Subjects has made its appearance. The valuable periodicals known as *Forschungs Berichte* and the *Jahresbericht über Fortschritte der Nahrungs und Genussmittel*, which were edited by Dr. A. Hilger and other collaborators, have been combined under the title *Zeitschrift für Untersuchung der Nahrungs-und Genussmittel.* The editors of the new journal are the well-known chemists Drs. K. v. Buchka, A. Hilger and J. König. Several original articles and a number of extracts appear in the first number, the whole comprising eighty pages of reading matter.

Reported Discovery of Strontium.—The discovery of a large bed of strontium at Put-in-Bay Island, reported from Toledo, has awakened a considerable amount of interest among the manufacturers of fireworks, as it is thought likely that it will result in a considerable reduction in the price of a fireworks in which strontium nitrate or strontium carbonate is used. One large manufacturer of fireworks in New York, who makes use of about 150 tons of strontium nitrate in a year, and imports the whole of it from Europe, states that it costs his firm now about 7¼ cents a pound. If the strontium should be found in large quantities, it would have the effect of lowering the cost of certain classes of fireworks, that is, all those that use a red or crimson light. At present the supply comes chiefly from Germany, and the American manufacturer has to pay a high price for it —*Scientific American.*

A call has been issued for a *Pure Food and Drug Congress*, to meet in Washington, March 2d, and to continue in session as long as the business before the convention may warrant. The movement originated with members of the grange, and has gradually spread to other organizations interested in pure foods.

The governors of each State are empowered to appoint 10 delegates each, divided as follows: Agriculturists, 4; pharmacists, 2; wholesale grocers, 1; retail grocers, 1; food manufacturers, 1; proprietary manufacturers, 1.

The governor will also appoint two delegates for the Department of Agriculture, and two to represent the Dairy and Food Division of the Department of Agriculture.

All State boards of health, boards of trade, granges, alliances, horticultural and agricultural societies, and sundry other organizations, are invited to appoint from 1 to 5 delegates.

Tampico Jalap.—Ordinary jalap, the "Purgo macho" of the Mexicans, is widely known as a medicinal substance, and the plant (Ipomœa purga,

Hayne) with purplish-pink flowers is met with under cultivation, not only in greenhouses in Europe, but to some extent as a field crop in the neighborhood of the Cinchona Plantations, in the Nilgiris (Madras) and the Blue Mountains, Jamaica, Tampico jalap, on the other hand, which has made its appearance in trade of recent years in considerable quantity, is produced by a different plant (Ipomœa simulans, Hanbury). It is stated to grow along the mountain ranges of the Sierra Gorda, in the neighborhood of St. Luis de la Paz, from which town and the adjacent villages the roots are carried to Tampico, and thence shipped abroad. As Tampico jalap was not represented amongst the plants in the Economic Collections at Kew, an effort was made to obtain a few tubers through the foreign office, who enlisted the kind co-operation of Her Majesty's Minister in Mexico. In November last, two lots of tubers were received in excellent condition from Her Majesty's Consul at Vera Cruz, labelled respectively "Tlacolulam" and "Tonayan," and described as having been obtained from these localities "in the Canton of Jalapa, in the State of Vera Cruz." The Tlacolulam tubers were distributed to the botanical departments at Jamaica and the Nilgiris, and to the botanic gardens at Oxford, Cambridge, Edinburgh, Glasgow, Glasnevin and Trinity College, Dublin. The Tonayan tubers (a small lot) were distributed to Jamaica and the Nilgiris only. It was at once noticed that both these tubers were not obtained from the locality where Tampico jalap is collected, and now there is little doubt that they are ordinary jalap (Ipomœa purga). This fact should be carefully noted by the recipients. In the meantime another effort is being made to obtain the tubers of the true Tampico jalap.—The *Kew Bulletin*.

OBITUARY.

Dr. Campbell Morfit, a distinguished American chemist, died in London, England, December 8th.

Dr. Morfit was born in Herculaneum, Mo., on November 19, 1820. His education was partly obtained at Columbian University, Georgetown, D. C., but he left there before graduation to take up the study of chemistry in the private laboratory of James C. Booth, in Philadelphia. Subsequently he engaged in the manufacture of chemicals, and in 1854 became Professor of Applied Chemistry in the University of Maryland. In 1858 he removed to New York, where he remained until 1861, when he went to London.

Dr. Morfit did considerable research work while in this country, but, after his residence abroad, devoted himself more particularly to the improvement of technical processes. He was a member of various scientific societies, including the Chemical Society of London and the Institute of Chemistry. Besides writing numerous scientific papers, he was joint author with James C. Booth of a report to the United States Ordnance Department on gun metal, in 1858, from investigations by him in a laboratory that he established on his own plan at Pikesville Arsenal, Maryland. He was co-editor with Dr. Booth, of the *Encyclopædia of Chemistry*. He also published the following: "Chemistry as Applied to the Manufacture of Soaps and Candles," "Chemical and Pharmaceutical Manipulations," "Pure Fertilizers and Phosphates," "The Arts of Tanning and Curing," "Perfumery: Its Use and Manufacture," "Oleic Soaps" and (with Dr. Booth) "Progress of Chemical Arts."

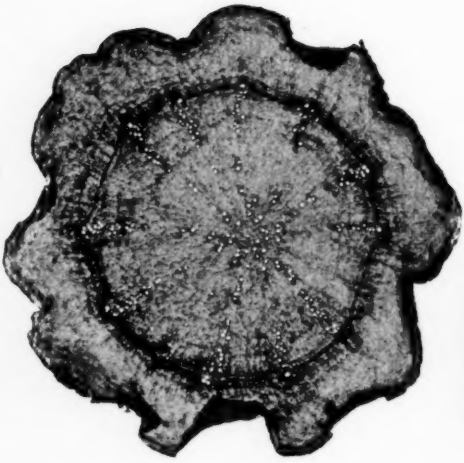

FIG. 1.—Cross-section of Canaigre Root.
x 5½ diameters.

FIG. 2.—Cross-section of Chinese Rhubarb.
x 5½ diameters.

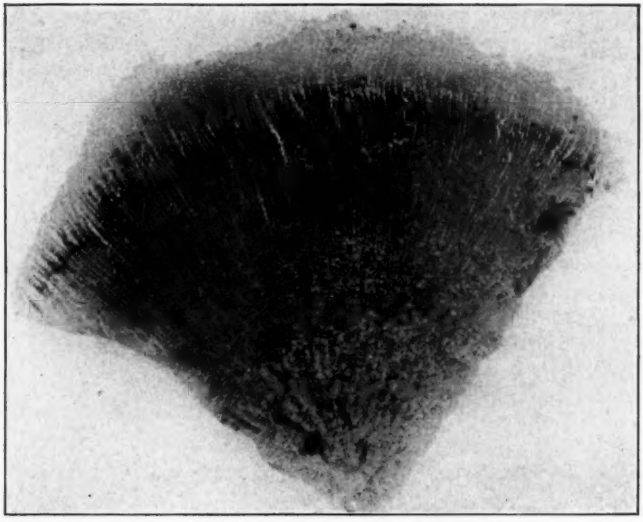

FIG. 3.—Cross-section of Rheum Rhaponticum.
x 5½ diameters.